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AUZAL



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MUNICIPAL PUMPING STATION AND RESERVOIR, HARRISBURG, PA.

Both grounds are embraced in the park system, the water is filtered, and the plant pays a profit to the city.

PUBLIC HYGIENE

BY

THOS. S. BLAIR, M.D.

Neurologist Harrisburgh, Pennsylvania, Hospital, Author "A Practitioner's Handbook of Materia Medica," "A Practitioner's Handbook of Modern Medical Treatment," etc.

ASSISTED BY NUMEROUS CONTRIBUTORS

IN TWO VOLUMES. VOLUME II

With 158 illustrations



RICHARD G. BADGER

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- 24 Red Star Line.
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Other photographs and drawings by the author.

CHAPTER XVI

IMMUNITY*

Introductory remarks upon natural and acquired immunity and disease antagonisms — Vaccination against variola — Other vaccines — Diphtheria antitoxin — Other sera — The procuring of such remedies for the poor — Their use in private and institution practice — Hydrophobia.

THE most primitive races commenced the study of immunity and then it was long forgotten, to be again taken up in the nineteenth century.

From the commencement of the eleventh century the Chinese and the Siamese inoculated variolus virus into the healthy human subject usually by inserting the same into the nostrils. The venom of the lance-headed viper has long been used (in attenuated form) to antagonize septic states. The oriental nations have employed various substances of an organic nature to produce immunity to various diseases and some of them not without a show of reason. The homœopathic “nosodes” have been long used upon the same basis, but are now little employed by that school. The Portuguese Colonel Serpa Pinto has given a graphic account of the methods of the Vatuas, on the east coast of Africa, in inducing an asserted immunity against serpent bites. As long ago as 1773 vaccination of cattle against pleuro-pneumonia was practiced in Europe, copied, no doubt, from the Moors and Pouls of Senegambia. Various forms of inoculation have been suggested and sometimes practiced during the frightful epidemics that have scourged the world. So, then, the question of immunity is not a new one nor is it one this age will completely settle.

Natural immunity is promoted by the many defenses of the body and sometimes by inflammatory processes. Leucocytosis, chemotaxis, phagocytosis, and the plasma and blood serum bactericidal powers all unite in producing a certain natural immunity. An acquired immunity may be due to a previous attack of the disease. Mild epidemics confer an immunity. Many diseases pursue a very mild course when inoculated upon the skin of a healthy person. This is true of plague, smallpox, cholera, and a few other diseases. Wright’s study of the opsonins and that made of immune agglutinins and precipitins, as well as specific antibodies, are all tending to enlarge the field of natural and induced immunity. The studies of Besredka

* Edited from literature supplied by the health boards and expressive of their point of view, but compared with the texts of laboratory workers.

Literature consulted — “Infection, Immunity, and Serum Therapy,” Ricketts—Sajous on the “Internal Secretions”—The literature of several State Boards of Health — Hygienic Laboratory Bulletin No. 36 — “The Question of Immunity,” a paper by L. H. Warner A.M., Ph.G., M.D.—“Materia Medica and Therapeutics,” by Blair — Several journal articles.

and Steinhart upon "anti-anaphylaxis" and the fact that the period of incubation in so many infectious diseases corresponds with the time required to sensitize animals with a strange proteid, tend to give hope to the students of the problems involved in immunity.

Jenner gave the greatest impetus to the practical application of protective vaccines, and the profession do not even yet fully appreciate the advances *now* being made. True, the advances are largely along the line of diseases affecting the lower animals, and we would urge the reader to turn to the appendix and read what is there said about these diseases. Vaccination against sheep pox, rinderpest, anthrax, and swine erysipelas are giving results arousing great hope for the success of human vaccination to protect against typhoid, human plague, tetanus, and other diseases. Naturally, we have not drawn the line between vaccines and sera in these general considerations.

From the exhaustion theory of Pasteur (1880) and on past the retention theory of Chauveau and the phagocytosis of Metchnikoff to the theory of Wright, as regards bacterial vaccines, is a long stretch in a short time. If history is written so fast during the next few years the reader will justify my decision to refrain from attempting to give the details of the studies in immunity recently made. The subject is developing too fast for a book writer, and it takes the journals to be very much awake to present the latest data.

This is one of the greatest subjects connected with hygiene, but at present it deals largely with what might be called experimental hygiene. This book deals with the distinctly practical, but the writer has read so much literature in the smaller medical journals and revealing so many warped points of view regarding vaccines and sera, that he cannot resist expressing some opinions. First, it takes years of patient work and many disappointments therein to bring to any practical conclusion any line of research involving immunity. Two mistakes are made here; the investigator publishes his data too early (or some scientific but scatterbrained enthusiast does it for him) and the other mistake is upon the part of the well-meaning but uninformed practitioner who rushes into the clinical field with half-cooked methods. This has had two recent illustrations. Wright's bacterial vaccines were under careful investigation, but the secret leaked before Wright was ready. In consequence, he was obliged to publish some partly prepared matter. When he used a vaccine, it was made from material derived from the patient's own lesion and after careful taking of the index. His results were good. But the commercial exploitation of the method must be quick as an extra edition of a newspaper after a prize fight and just about as dignified. Bacterial vaccines were advertised by several houses and sold to every one who wanted to play with fire. The result has been bad all around and the general practitioner has dropped the method, badly damaged at his hands. The same thing happened to Koch when he first announced tuberculin or, as it was called, "Koch's lymph." It has taken years for tuberculin to be recognized again as a useful agent, but, fortunately, while he still lives. Even at present many poorly informed persons are rashly using tuberculin diagnostic tests.

Second, from considerable laboratory experience and twenty years of general medical practice, the editor is fully convinced that no physician is

qualified to use most of these newer methods unless he has personally and practically learned modern laboratory methods. The technic of vaccination for smallpox and serum infection for diphtheria are so well worked out that any intelligent physician is qualified to use them. As to estimating the opsonic index and using bacterial vaccines or the tuberculin diagnostic tests, he had better wait a few years until they are simplified. Merely buying a laboratory outfit without a careful course of instruction before the purchase is about as foolish a thing as a man can do.

Third, the Pasteur treatment designed to produce immunity to rabies is an illustration of how these scientific and complicated means for immunization should be handled. Men trained in the work are alone engaged in the practical application of the method. If the same rule prevailed with reference to bacterial vaccines and the use of tuberculin, these methods would doubtless be speedily recognized as effective within a reasonable field.

Very unfortunately, many men find expression for views antagonistic to scientific medicine. It is a long and hard trail for anything that tends "upward and onward," but for physicians to endeavor to drag back to empiricism again the advance of modern science is a sight to make the angels weep. And yet some of the physicians who so strenuously oppose vaccination and other methods are very excellent gentlemen and simply have not been granted the same vantage point as have those others who are upon the firing line of advance. But, upon the other hand, it is aggravating to see young men arising with the cock-sure attitude so many assume, but get knocked out of them in a few years. No laboratory graduate should write a thing except pure science until after he has practiced medicine for five years. There is a large proportion of very immature data and conclusions see the light to their author's ultimate chagrin. The class of physicians who oppose the laboratory man and the application of laboratory methods find excellent material for argument in the publications upon immunity. The subject is being overworked without much being added thereto. What is needed now is three years of hard work and silence.

But ultimately everything points to a time when science will win many more victories over disease. The phrase *preventive medicine* will include *preventive therapeutics* after a while. Read the chapter in this book upon "epidemics," and consider how much has been done to mitigate them (nearly always fought by many doctors) and one cannot but realize that with so many brilliant men working toward better things, the twentieth century will witness a wonderful work for the betterment of mankind through preventive medicine. The author has carefully studied the therapeutics of the regular, the homœopathic, and the eclectic schools, and is justified in his conclusion that there is no need for school in the scientific part of therapy, and no need for the therapy that is not based upon science. Therefore, let *all* advance.

Vaccination against variola.—As this is not a work upon pathology or therapeutics, smallpox need not be discussed, except as regards its mortality in epidemic. This matter is dwelt upon in the chapter upon epidemics, but a few quotations will be given here that will serve a physician in converting a recalcitrant patient:

Lord Macauley said in writing of the death of Queen Mary, in 1694, "The small-pox was always present, filling the churchyards with corpses, tormenting with constant fears all whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover."

And if any one believes that this disease has lost its power, let them communicate with the Japanese government and ask for their report upon small-pox in Korea, a country they are reconstructing; or ask the great traveler and writer, Frank Carpenter, what he has seen in that country, every hamlet of which shows the shocking marks of this filthy scourge, and where no mother counts the number of her children until after they have all had smallpox.

In the years 1873-1874 there died in the East Indies about 500,000, and in 1875-1876 about 200,000 people from smallpox. During this time, among 120,000 Europeans in the same country there were only two deaths from smallpox. This immunity can be attributed to the thorough and rigorous enforcement of vaccination. In the British census of 1881, the number of children under ten years of age in London was 916,784, which was divided into about 55,000 unvaccinated and 861,000 vaccinated. In the same year the deaths from smallpox were as follows: 782 among the 55,000 unvaccinated and 125 among the 861,000 vaccinated, or one in seventy of the former to one in 8,966 to the latter; a difference of nearly one hundred fold in favor of the vaccinated class. If the London children under ten who were unvaccinated had had the protection which the virus gives, not 782 of them would have died of smallpox, but only 9. If the 861,000 vaccinated children had died at the rate of the 55,000 unvaccinated, we would not be considering 125 smallpox deaths and how they can be reduced, but we should be confronted with the appalling addition of 12,000 and more deaths from smallpox occurring during that year in the London population of children under ten years of age. The very success of vaccination has blinded people to its importance. It is easy to be bold against a danger which is absent. It is easy to despise the antidote when one has no painful experience of the bane.—RAYMOND RUSS.

I have asked Samuel H. Orwig, Esq., for an expression of opinion concerning the legality of compulsory vaccination in the United States. He replies as follows:

The legislature has power to pass an act compelling vaccination. Danger to public health is sufficient ground for the exercise of the power conferred whenever an epidemic of smallpox is present or may be reasonably apprehended.

In American State Reports, Vol. 66, page 251, the Supreme Court of the United States, in an opinion by Gray, J., says: "We hold that the legislature has power to pass an act compelling vaccination, and that it may delegate this authority to a municipal corporation. *But while this is true municipal corporations must have express authority from the legislature as no such power will ever arise from implication.*"

The natural rights of the individual must yield whenever the concession is demanded by the welfare and health of the public.

We have examined the vaccination laws of quite a number of the states and find a distinct variation. Utah has a statute *against* compulsory vacci-

nation of any class of individuals, inclusive of pupils in the public schools, but the law is too recent to tell what will be the outcome. It was passed by the legislature, vetoed by the governor, and passed over his veto. Pennsylvania has a compulsory school attendance law and another one demanding vaccination of all pupils. Some parents refuse vaccination for their children, and thus the two laws are brought into conflict. There is sufficient legal ground to permit an honest advocate of vaccination to pause before advocating *compulsory* vaccination, but such measures may be very reasonably drawn, and a marked instance of a good compulsory law is the one here given in reproducing the law of Maryland.

VACCINATION LAWS OF MARYLAND

AS AMENDED BY ACT OF ASSEMBLY. APPROVED APRIL 5, 1900

VACCINE AGENCY

Public General Laws, 1888. Art. 43

25. A state vaccine agency is established, said agency to be located in the city of Baltimore, in which place shall be kept, at all times, a supply of fresh and pure vaccine virus, if practicable, not more than four removes from the cow, for the use of physicians residing and practicing medicine in this state.

1864, Chapter 269, Section 2

26. The governor, by and with the advice and consent of the senate, shall, once in six years, appoint as state vaccine agent, one physician of good character and standing, whose duty it shall be to keep on hand, and to procure as often as may be necessary, pure vaccine virus, and to furnish such virus to the physicians of the state gratuitously, when called for. He shall keep a record of the name and location of each physician so furnished with virus, together with the quantities, qualities, and number of times. He shall be required to advertise once each month in one of the papers published in the city of Baltimore, and once during the year (three insertions) in one paper of each county. He shall for this service as state vaccine agent receive an annual salary of six hundred dollars, and to defray the expenses incurred by him in procuring reliable vaccine virus; and to further carry out the provisions of this section the additional sum of fourteen hundred dollars is hereby appropriated, said salary to be paid in quarterly installments, as other state officers are now paid; and it shall be competent for the governor, at any time, to remove said agent for neglect, incompetency, or unfaithfulness of any kind, and in case of death, resignation, or removal for any of such causes, to appoint another in his stead, who shall hold office for the unexpired term of such agent.

1864, Chapter 269, Section 3

27. For every child vaccinated, whose guardian or parents are too poor to pay for the service, the county commissioners of the several counties or the mayor and city council of Baltimore, as the case may be, shall pay or cause to be paid to the physician performing the service, the sum of fifty cents for every such case, on presentation of such account duly authenticated by an affidavit, setting forth that the service was duly performed and that the parents or guardian are unable to pay for said service; provided, that in the counties or in the city of Baltimore, where vaccine physicians are appointed by the proper authorities to vaccinate all persons who may apply, the county commissioners of such counties and the mayor and city council of Baltimore

shall be respectively freed from the payment of fees to other physicians for vaccinating those unable to pay, and county commissioners are hereby authorized and empowered to make contracts with and designate such vaccine physicians as they deem necessary.

Ibid., Section 4

28. It shall be the duty of every practicing physician in this state to vaccinate all children in the circle of his practice which may be presented to him for vaccination within one year after birth, if such child shall be in a proper condition for such service, and he shall vaccinate all other persons not previously effectually vaccinated, who shall request such service from him. A physician neglecting or refusing to do so shall, on conviction thereof, forfeit and pay for every offence a penalty of five dollars.

Ibid., Section 5. 1872, Chapter 257, Section 5

29. Any physician who shall knowingly and wilfully use any virus defective in its nature, by having passed through a scrofulous system from having been taken from one laboring under any disease of the skin, chronic sore, or other febrile, or other disease during the progress of the vaccine disease, or any crust which, during the progress of said vaccine disease, was punctured, or had sustained other injury, shall, upon conviction thereof, forfeit and pay a sum not less than one hundred nor more than five hundred dollars for each offence.

Ibid., Section 6

30. It shall be the duty of every parent and guardian to have his or her child vaccinated within twelve months after its birth, if it shall be in proper condition, or as soon thereafter as practicable; and if such parent or guardian shall have any other person under his or her control, or care, not duly vaccinated, he or she shall cause such person to be vaccinated prior to the first day of November of each year. Any person failing to comply with the provisions of this section shall, on conviction thereof, forfeit and pay the sum of not less than five or more than ten dollars for each offence.

Chapter 337, Acts of 1900

31. No teacher in any of the public schools of this state shall receive into such school as a pupil any person who has not been successfully vaccinated; and it shall be the duty of all teachers in the public schools, within ten days after the beginning of each fall term of said school, and thereafter as new pupils shall enter such school, to ascertain and enroll on the vaccine register of said school the names of those pupils who may produce certificates of a regular practicing physician of the county or city, as the case may be, certifying that the pupil has been successfully vaccinated, and also the names of those pupils who have been enrolled at any previous term in any school of the county, or in the city of Baltimore, as the case may be, as successfully vaccinated pupils, whenever any such pupils shall present a certificate of such enrollment from the teacher of any such school. If any person shall apply for admission as a pupil in any of the public schools of this state, who has not been successfully vaccinated, the teacher shall give the parents, or guardian or other person having control of such pupil, an order directed to any physician in the county or city, as the case may be, and requiring any regular physician to whom it may be presented, to vaccinate such pupil, and return a certificate of such vaccination, when successful, to the teacher giving such order. The county commissioners of the several counties and the mayor and city council of Baltimore city, as the case may be, shall pay or cause to be paid to the phy-

sician performing the services on such orders, the sum of fifty cents for every successful vaccination on the presentation of the order and certification of the teacher that such vaccination has been performed; provided, that in the counties, or in the city of Baltimore where vaccine physicians are appointed, or contracts made, with certain physician by the proper authorities for the vaccination of all children or persons who may apply free of charge to the person applying, the provisions of this section providing for the payment of physician certified orders of teachers shall not apply. Any teacher neglecting or refusing to comply with the provisions of this section shall, on conviction thereof, before any justice of the peace having jurisdiction over said offence, be fined ten dollars for each and every offence; and no public school trustee or commissioner shall grant any permit to any person who has not been successfully vaccinated, to enter as a pupil any public school, under the same penalty.

1872, Chapter 257, Section 8

32. All fines imposed under the provisions of the four preceding sections shall be recovered before a justice of the peace in the same manner as small debts are recoverable, for the use of the school fund of the county or city in which such offence shall occur.

1867, Chapter 6. 1872, Chapter 257, Section 11

33. The state vaccine agent is hereby required to take all steps necessary to reproduce from the cow true vaccine virus, for the use of physicians residing and practicing medicine and surgery in this state, and shall furnish none more than four removes from the cow, if practicable, and none that has not been produced under his own supervision and direction; *provided*, that he may take, use, and furnish such virus furnished to him by any physician intrusted by him to procure the same, such virus not to be taken from the arm of a child less than three months old; and the said agent shall report annually to the governor the particulars of his expenditures, and other matters connected with the duties of his agency.

34. The state vaccine agent shall give bond to the state of Maryland in the sum of three thousand dollars, conditioned for the faithful performance of his duties; said bond to be approved by the comptroller of the state.

From the *Pennsylvania Medical Journal* for January, 1909, we take from the transactions of the Philadelphia County Medical Society printed therein some remarks by Hampton L. Carson, Esq., as follows:

I shall confine myself strictly to the judicial aspects of the matter, leaving entirely out of view those considerations which appeal solely to legislative discretion. The question to be dealt with is whether, assuming that the legislature, after listening to debate upon the propriety of safeguarding the public health by legislation enforcing compulsory vaccination, adopts such a statute, such a statute is within the constitutional power of the legislature, and whether it is free from the objection often urged, that it is an invasion of the personal liberty of the citizen. This aspect of the matter was very recently presented to my attention by reference to Osler's Practice of Medicine in which it is stated substantially that a large unvaccinated population had grown up in Montreal in consequence of the prejudice against vaccination. One Pullman car conductor suffering from smallpox came from Chicago to Montreal on February 28, 1885. Within the next ten months several thousand cases of smallpox occurred, and 3,184 persons died out of a population of 185,000, to say nothing of the deformity, blindness, and other unfortunate and repulsive results. This impressive statement was added to by the remark of my correspondent that he had found a number of persons who objected to vaccination on the ground that it was an invasion of personal liberty, and he added that he would like to ask *per contra* whether it was not

an invasion of the personal liberty of all the citizens of Montreal when one man was allowed to make thousands sick and deformed, and kill 3,184 people simply because that one person was not vaccinated; and he added: "It seems to me as clear as daylight that the community has a right to protect itself and prevent any such death-dealing invasion as shown in this particular instance and many other similar ones." The answer is plain. Assuming that a legislature is satisfied that the presence of an unvaccinated person is a menace to public health, and therefore passes a statute making vaccination more or less compulsory, is the passage of such a statute within the constitutional powers of the legislature, and is it free from the objection that it is an invasion of the personal liberty of a citizen who does not believe in vaccination? The answer to this question under the law is plain and certain and free from doubt. In every well-ordered community there exists a power generally known as the police power, an attribute of sovereign power as may properly restrain and control a citizen and his occupation in such a manner as may be necessary to promote the health, safety, and welfare of society. It is that inherent and plenary power in the state which enables it to prohibit things hurtful to the comfort, safety, and welfare of society, and a power, moreover, which remains with the state governments to enable them to regulate for their own welfare as they understand their welfare and their internal or domestic concerns. Coming to the specific matter of vaccination, the Supreme Court of Pennsylvania has expressed itself in no uncertain terms: "At present the vast preponderance of opinion among intelligent and educated people, under the guidance of the best medical authority, is that vaccination is a highly useful ameliorative, if not always a preventive of one of the greatest scourges that have in past times afflicted humanity, and that regulation of it by statute is not only justifiable but a wide and beneficent exertion of the police power over the public health.

The legislature has not as yet gone to the length of compulsory vaccination. It has required the exclusion from all schools of unvaccinated pupils or pupils who could not produce certificates of successful vaccination, and the law of exclusion is binding upon teachers, superintendents, and principals. The penalty seems to be the loss of education at the expense of the state.

The purposes of this paper are met by the demonstration of the existence of the power, and therefore it follows that should the consensus of medical opinion require more stringent and drastic provisions than are now found in the law, and the legislature can be persuaded of the propriety of adopting them, no question can be successfully raised in the courts to challenge the authority of the statute.

The historian, the statistician, and the lawyer have spoken, but we have reserved to the last the *one* argument that is guaranteed to convert the recalcitrant patient. It has been published by the wise Illinois Board, and is as follows:

BEAUTIFUL WOMEN AND VACCINATION

A little over a century ago a beautiful woman evoked the wildest enthusiasm, for there were so few women whose faces were not disfigured by smallpox. Smallpox was then so universal a disease that Ben Jonson wrote of it,

Envious and foul disease, could there not be
One beauty in an age and free from thee?

It has been said that if an Englishman of the eighteenth century were to return to life and revisit London, he would be astonished, not so much on account of the wonderful progress made in the arts and sciences within the past one hundred years, as over the absence of pock-marked faces.

The medical aspect of vaccination is so well understood by the profession that it is unnecessary to enter into a discussion here. All works upon the practice of medicine give pretty full data. Those who wish an exhaustive article should read the chapter by Dr. Geo. Dock, in Osler's "Modern Medicine." The profession as a whole are fully agreed upon the efficacy of the procedure, and the anti-vaccinationists are not growing. The editor made it a point to be in Philadelphia at the time of the last convention there of these people. Their meetings evoked no enthusiasm, except among a small coterie, and the arguments were those already exposed as fallacious. Gloucester, England, was the former center of this propaganda until an epidemic of small-pox occurred, with 1,979 cases and 439 deaths. After vaccination was enforced the epidemic rapidly subsided, and the propagandists were among the first to be vaccinated. I was in Cleveland, Ohio, about the time of its agitation against vaccination and the resulting epidemic. I was back there recently, and to state that the city is "soundly converted" puts it mildly.

Vaccination should be performed with due regard to surgical cleanliness, and the same care should characterize the wholesale vaccination of a "scare" as characterizes that done in private offices. Unfortunately this is not always the case, and I plead guilty of having helped "railroad" a long waiting line of school children. Such mobs as sometimes overwhelm the hospital and city physicians are more the fault of "orders from up higher" than from the preferences of the physicians themselves. Nevertheless I have rarely seen any harm result from these flurries, and it confirms my confidence in the harmlessness of the little operation when done with any reasonable regard to propriety. The method of scarification is now a subject of discussion, and a clean but superficial incision seems to be growing in favor over the method of denuding the cuticle by scraping. When an incision is used, two or three are made fairly close together. Shields and elaborate protective devices are losing in favor. Every physician is apt to follow his own technic and succeed with it, and it impresses me as unwise to be dogmatic over the matter.

Certificates vary in form, that of New Jersey impressing me favorably. It is here appended:

CERTIFICATE OF VACCINATION

....., N. J. 190....
 This is to certify that.....
 aged..... years, was vaccinated by me..... 190....
 I personally examined said person..... 190...., and found
 that said vaccination was.....
 [Successful or unsuccessful.]
 Signature....., M. D.
 [Date of previous successful
 vaccination.]
 Address.....

Pennsylvania provides a certificate for recent vaccination, but the word "recent" is not defined:

I hereby certify that on the..... day of..... 190....
 I examined a cicatrix on.....
 Age.....Address.....
 and believe it to be the result of a successful vaccination.
M.D.
 Address.....

All certificates bearing date after Sept. 15, 1905, must be in above form.

The general policy here is to regard vaccination as effective for five years. A blank similar to the above contains a line: "and found well-defined cicatrices from smallpox."

Health boards all over the country, as well as many governmental organizations, provide free vaccination.

Malandrinum (grease in horses) and variolinum (lymph from the small-pox pustule) are two substances run up to "high potency" and used internally by some of the "homœopathic purists" to protect against, modify, and cure smallpox, and as a remedy for the "ill-effects of vaccination." From inquiry, I learn that the "purists" are the followers of Kent, and have a medical society of their own, since the great mass of homœopathists do not agree with them, and this national society is said to number only about four hundred members. That is all there is to the "internal vaccination," so far as I can learn. It appears to be the remnants of some of the ancient means devised for the much desired cure of this disease so terrifying to the nations of the earth before the wonderful discovery of Jenner.

Other vaccines.—The study of opsonotherapy is highly interesting and certainly promises results that may be a long time or a very short time in coming to some definite ending, for or against. If one be guided solely by the many journal articles, it is very easy to become an enthusiast. It is doubtless true that many cases of streptococcic and staphylococcic infection, and especially acne and furunculosis, have been cured by the appropriate vaccine. Some cases of chronic gonorrhœa and of localized tuberculosis seem to have yielded excellent results. It would be pedantic to deny that a good beginning has been made in the application of these vaccines. But we are all entitled to our opinion and (as has been expressed in the early portion of this chapter) it impresses me that it is unwise for the makers of these products to sell them, as yet, to any but well-trained investigators. It would be well, in my view of the case, to limit their employment to well-equipped hospitals and to laboratories of hygiene and of investigation. It is not possible for laboratory-made products of this class to do as well as do those made from the lesion of the patient himself.

Gentlemen who do not agree with these conservative views can find an abundance of literature to guide them in the use of these products. Those who do not care to spend money for literature can send to Parke, Davis & Co. for copies of their booklets, entitled, "Serums and Vaccines," and "Tuberculin in the Diagnosis and Treatment of Tuberculosis."

The journal of the American Medical Association, February 6, 1909, contains an editorial giving the cream of the conclusions thus far derived from the investigations of "anthreptic immunity" in cancer, quite a different line of study upon immunity directed to the long hoped for solution of the problem of cancer. Thus far the work has been upon the lower animals.

Diphtheria antitoxin.— It impresses me that the works upon the practice of medicine give such full data upon the employment of antitoxin in diphtheria that little need be said here; especially is this true in view of the fact that the status of the serum is so established that discussion is useless. The important thing for physicians to learn about *diphtheria* is to *diagnose early* and to give *antitoxin early* and in *sufficient dosage*. Permit me to call especial attention to the following wise words of Dr. Hill:

In the chairman's address, Laboratory Section of the American Public Health Association, Dr. H. W. Hill, director of the Minnesota Board of Health Laboratories, in discussing "Time Limit Versus Culture Limit in Diphtheria Release," said in his concluding paragraph:

But wherever the truth may lie as regards the handling of convalescents from diphtheria, the fact seems to be that whether handled by time limit or by culture limit, rather less than two per cent of new cases are accounted for by failures in either method. Since diphtheria morbidity is not on the decrease, although its fatality is, every case of diphtheria now existing must give rise on the average to one new case. The settling of the question as to convalescents, however interesting, will necessarily leave ninety-eight per cent of the reproduction of diphtheria unaccounted for. It would seem much more important to search for the methods to control the, as yet, evidently uncontrolled source of this ninety-eight per cent than to devote all attention to search for those errors in handling convalescents which result in the reproduction of at most two per cent. If we may tentatively accept the teaching that diphtheria is chiefly reproduced by early, unrecognized, and concealed cases, the ultimate control of diphtheria to the point possibly of abolition becomes a matter of early diagnosis, which involves culture taken from *all* sore throats, with isolation until the report is received, or the prompt immunization of *all* sore throat cases, together with the immunization of all potential receivers — *or* a judicious combination of both methods, "a word and a blow — the blow first," i.e., give antitoxin first and inquire about it (by means of a culture) afterwards.

I have before me the special pamphlets upon diphtheria issued by the boards of health of twenty-three states, all very excellent little publications, and yet few of them emphasize these points made by Dr. Hill. The best one of all is the Bulletin of the State Board of Health of Maine, for July, 1907. It is a "special diphtheria number, edition of 1907." It will pay any physician to send ten cents to the secretary of the board at Augusta, for a copy. "slight sore throat," "chronic diphtheria," and the persistence of the bacillus in the throat are discussed in it. Antitoxin has a greater future as an immunizing agent than as a curative one, despite its known value in the latter direction.

Personally, one thousand units seems best for purposes of immunization, and I believe in using such doses in every suspicious case, even before a diagnosis can be made.

The federal hygienic laboratory has decided that "The refined antitoxic serum, bulk for bulk, is quite as toxic to sensitized guinea pigs as the untreated serum from which it was precipitated and dialized. There is, however, a distinct advantage gained in using the concentrated serum, as the same number of units may be given in half the bulk, and it is well known that the serum reaction in man depends partly upon the quantity of serum given.

Serum from one horse appears quite as toxic as serum from other horses. The apparent differences seem to depend upon something connected with the sensitizing action.

The immunity produced by repeated injections, termed "anti-anaphylaxis," by Besredka and Steinhardt, appears to be relatively not quite as lasting and definite as many instances of active immunity against bacterial infections.

The question of sensitized individuals and sudden death following the injection of diphtheria antitoxin is one upon which I have failed to secure any conclusive data from the clinical standpoint, and one in which I have had no experience. From what I can gather from the experience of health boards, they seem to regard it as an academic problem. It may be well to avoid giving small doses at some interval, especially since large initial doses seem to do little if any harm. Dr. G. E. Learn, of Hamburg, N. Y., reports giving as high as sixty-two thousand units within fifty-four hours. The case recovered. On the other hand, I have known of large doses given *late* doing much *apparent* harm, but the actualities in these late cases are hard to estimate.

Other sera.—Antitetanic serum seems to be fairly established and the polyvalent sera are of defined clinical efficiency, while there is scientific ground for the careful employment of others. Thus far, the United States health authorities have not done much with these sera except to conduct laboratory experiments. But the United States Public Health and Marine Hospital Service is standardizing them.

Abroad, however, more has been done. The prophylaxis of typhoid was well tried out in the English army during the Boer war. Sir A. E. Wright prepared serum for forty thousand injections and claimed in his book, "A Short Treatise on Typhoid Inoculation," that no cases of the disease developed in persons who had received two injections. But his method was sharply criticized and was discontinued, although the Army Medical School sustained him, after a rather elaborate investigation. In Massachusetts, in this country, Richardson and others conducted elaborate experiments with bacterial products and reported a high mortality. I regret that the original reports are not in my hands, but fragments of them have appeared in various journals. As *curative* agents certain bacterial products for typhoid, cholera, etc., have been a distinct failure, probably because, as suggested by Pfeiffer, the bacterial elements are found largely in the intestinal tract; but, as regards immunity, there is substantial ground for hoping that skilled use of them will be justified.

The procuring of sera for the poor.—Pennsylvania is one of a few states whose state boards of health have an antitoxin division and, through distributing stations, supply diphtheria antitoxin absolutely free. Very many states supply it at absolute cost. A vast deal of good has been done by such

distribution and the system is to be commended as most worthy of further elaboration. To me, it is a great source of satisfaction to know that if I am called to a case of diphtheria demanding antitoxin, and the family are unable to pay for the same, just a block away from my office is a supply subject to my call. Every physician should inform himself as to the necessary formalities required to avail himself of the state aid afforded by his own immediate locality and the locations of the nearest stations of distribution. If your state does nothing in this line, you may help formulate a public opinion that will result in the legislature making special appropriation.

Their use in private and institution practice.—In view of the danger intimated in the quotation from Dr. Hill, there is a peculiar responsibility devolving upon physicians involved in the care of large bodies of children under the same roof. When one looks back to the time when diphtheria ran riot through a ward, and we reflect that *now* we can immunize the babies, we cannot be too careful in our scrutiny of every sore throat. The safest plan is to isolate every child developing a sore throat in the ward. With all deference, may I say that the physician who has not read the recent literature upon the cases carrying a chronic infection and upon the dangers of the mild cases, should carefully do so at once? With sorrow, may I add that I have had occasion to find that Dr. Hill is right.

Hydrophobia.—After proving that immunity to this disease was readily attained in dogs, Pasteur applied his great discovery to man and, of the first three hundred and fifty persons treated, but one died. This was the most pronounced demonstration of the principle of immunity ever made and its full narration reads like fiction. So complete is the demonstration of the efficacy of the treatment as used in the many Pasteur Institutes, that all we need say here is to send patients *at once*. This method produces immunity, but will not cure a case developing to a clinical stage.

Suspected dogs should be shot through the heart or lungs or poisoned with strychnia. Do not mutilate the head, but remove it, and the neck from the body, pack in ice and send by express to the laboratory. In cold weather or for a short distance the ice is not needed. Any pathological laboratory can readily identify the Negri bodies, which are characteristic and definitely diagnostic.

CHAPTER XVII

EPIDEMICS

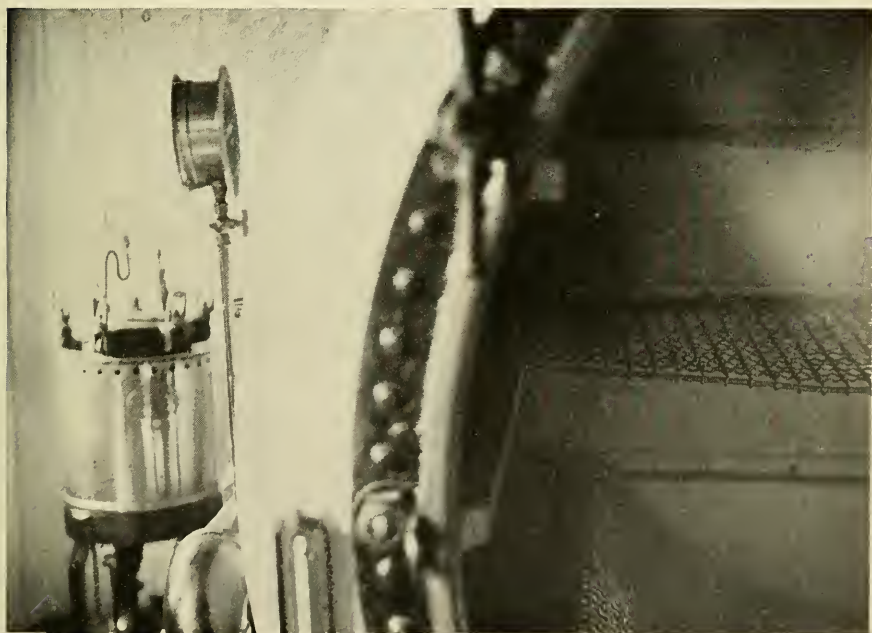
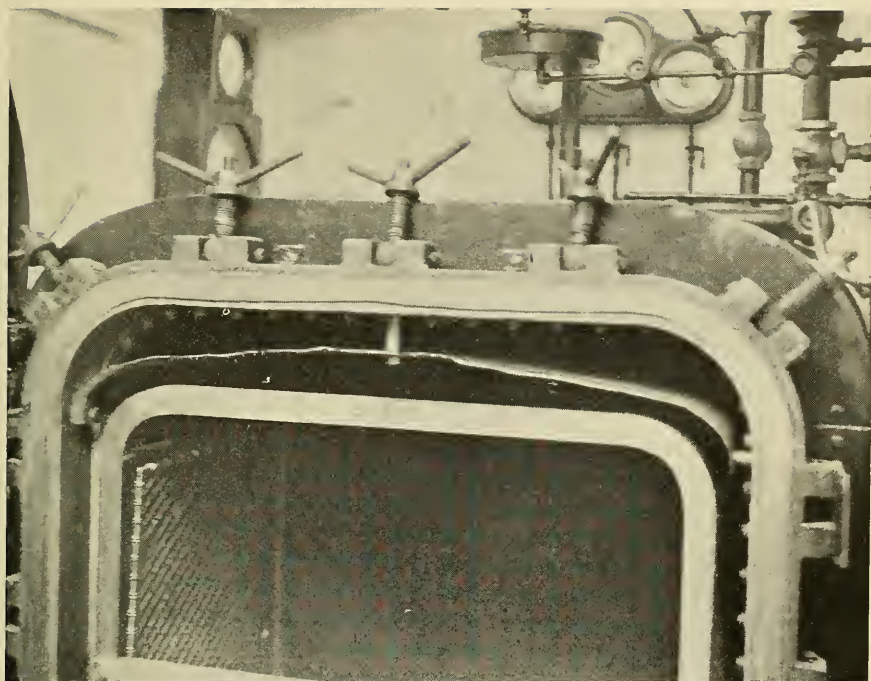
History of — Present status of — Conditions favoring and preventing — Geographical considerations — Trade features — International considerations — The police power — How to meet epidemics under ordinary conditions — In war — Special conditions and measures — When to apply for state aid and what state may be empowered to do — “Shot gun quarantine” — Abandoned measures — Federal aid — Savage countries — The march of trade — The “white man’s burden” — Camp epidemics — The outlook.

I believe that disease, contagion, and epidemics of sickness have done more than any one thing to bring home finally to men’s business and bosoms the realization of the double truth that no man can calculate for his own welfare without calculating for that of everyone else, and that the best calculation of evils is to anticipate and prevent them, instead of awaiting them and fighting them after they have done their worst. To prohibit is to make the wiser calculation. We realize that the prevention of disease, crime, intemperance, accident, food adulteration, and poverty is not only more humane, but vastly cheaper.— W. I. THOMAS.

THE various chapters upon boards of health, disinfection, quarantine, camp hygiene, immunity, etc., cover so many of the features involved in epidemiology that this present chapter needs be but brief, and no adequate reason exists for repeating matter here that is given elsewhere. Hence, an adequate idea of the present subject must be derived from a study of practically the whole range of this present volume.

The Bible narrates much of epidemics and ancient history is full of references to visitations of plague and epidemic disease in camp and city. One would have to write a history of ancient civilization to express the fear and superstition that for ages had a hold upon men because of “the pestilence that walketh in darkness and the destruction that wasteth at noonday,” and the instance of the Hebrews escaping from the Egyptians because of epidemics among the latter people is not the only one of nations rising and falling because of disease. The sword and fire of battle has killed its hosts, but the diseases of the army camps have slain their myriads. How much of what passed as religion in history was prompted by fear of demons disseminating disease or angry deities malevolently showing their power over men may never be known. The middle ages were punctuated with epidemics and “religious” horrors.

Prof. J. F. C. Hecker, M.D., of Berlin, wrote, early in the nineteenth century, three treatises upon different epidemics in the middle ages. The Sydenham Society of London translated these volumes into English, and has rendered available for us a ghastly but interesting history. From Hecker’s introduction let me quote the following:



DISINFECTING APPARATUS, FUMIGATING BOAT, NEW YORK HARBOR
UPPER DEVICE EMPLOYS STEAM; LOWER ONE, FORMALDEHYDE

No epidemic ever prevailed during which the need of more accurate information was not felt, and during which the wish of the learned was not loudly expressed, to become acquainted with the secret springs of such stupendous engines of destruction. Was the disease of a new character? The spirit of inquiry was aroused among physicians; nor were the most eminent of them ever deficient either in courage or in zeal for investigation. When the glandular plague first made its appearance as a universal epidemic, while the more pusillanimous, haunted by visionary fears, shut themselves up in their closets, some physicians at Constantinople, astonished at the phenomenon, opened the boils of the deceased. The like has occurred both in ancient and modern times, not without favorable results for science; nay, more matured views excited an eager desire to become acquainted with similar or still greater visitations among the ancients; but as later ages have always been fond of referring to Grecian antiquity, the learned of those times, from a partial and meager predilection, were contented with the descriptions of Thucydides, even where nature had revealed, in infinite diversity, the workings of her powers.

If one should be so rash as to call in question the value of scientific and laboratory investigation, surely this quotation, as viewed in the light of present knowledge, should make him thankful that patient men with microscope and reagent have solved so many mysteries of our forefathers.

The black death of the fourteenth century destroyed a large portion of the human race. Literally, it was "a convulsion of the human race, unequalled in violence and extent. It speaks of incredible disasters, of despair and unbridled demoniacal passions. It shows us the abyss of general licentiousness, in consequence of a universal pestilence, which extended from China to Iceland and Greenland." Thirteen million persons are said to have died in China alone, India was nearly depopulated, aside from China twenty-four million souls perished in the Orient. In Venice, one hundred thousand perished and half that number in Paris. Hundreds of thousands died in England, Italy lost half its inhabitants, Spain suffered horribly, and it is estimated that at least one fourth of all the people of Europe perished.

The passions of men seized upon religious pretext in order to commit wretched and sordid crimes and the church itself resorted to the most unbridled persecution of Jews and ceremonies speaking volumes of the ignorance of the age. On the other hand, the truly religious in and out of the church were aroused to the sense of the abuses of the age that finally led to much of true reform.

The medical authorities of the time regarded the bubonic plague as due to a grand conjunction of the three superior planets, Mars, Jupiter, and Saturn, on the 24th of March, 1345. A few of the more rational ones attributed the disease to causes other than astral and believed that the habits of the people and impure air had much to do with the spread of the disease.

Quite of another nature was the dancing mania of Germany and the Netherlands, and which started in 1374. The people, according to Raynald and Lucae, in the "Annals Ecclesiastic,"

formed circles hand in hand, and appearing to have lost all control over their senses, continued dancing, regardless of bystanders, for hours together, in wild de-

lirium, until at length they fell to the ground in a state of exhaustion. They then complained of extreme oppression, and groaned as if in the agonies of death, until they were swathed in cloths bound tightly round their waists, upon which they again recovered, and remained free from complaint until the next attack. This practice of swathing was resorted to on account of the tympany which followed these spasmodic ravings, but the bystanders frequently relieved patients in a less artificial manner, by thumping and trampling upon the parts affected. While dancing they neither saw nor heard, being insensible to external impressions through the senses, but were haunted by visions, their fancies conjuring up spirits whose names they shrieked out; and some of them afterwards asserted that they felt as if they had been immersed in a stream of blood, which obliged them to leap so high. Others, during the paroxysms, saw the heavens open and the Saviour enthroned with the Virgin Mary, according as the religious notions of the age were strangely and variously reflected in their imaginations.

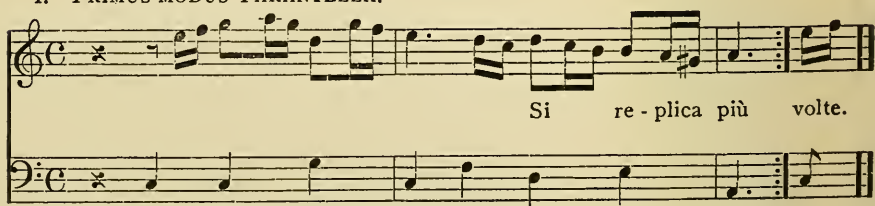
The mania took the form of tarantism in Italy. This was a strange admixture of the musical and the sensual and they were appealed to by anything of a red color and the devotees of this cult indulged in a riot of color and glistening objects. I have had some of the peculiar music reproduced that I might judge of its nature and it sounds like Turkish music. To this day the Italians use some of the tarantella music for dancing. A short selection is here reproduced and I append a few of the lines:

Stu pettu è fattu Cimbalo d'Amuri:
Tasti li sensi mobili, e accorti:
Cordi li chianti, sospiri, e duluri:
Rosa è lu Cori miu feritu à morti:
Strali è lu ferru, chiai so li miei arduri:
Marteddu è lu pensieri, e la mia sorti:
Mastra è la Donna mia, ch' à tutti l' huri
Castando canta leta la mia morti.

MUSIC FOR THE DANCE OF THE TARANTATI, from ATHAN KIRCHER

Magness. de Arte magnetica. Rom. 1654, fol. p. 591. Repeated in Sam. Hafenreffer, Nosodochium, in quo cutis affectus traduntur. Ulm. 1660, 8vo, p. 485.

I. PRIMUS MODUS TARANTELLA.



II. SECUNDUS MODUS.

Si re - pli-ca più volte.

III. TERTIUS MODUS.

Si re - pli-ca più volte.

The sweating sickness.—In 1485 the victorious army of England was suddenly smitten with an illness described by Holinshed as follows:

For suddenlie a deadlie burning sweat so assailed their bodies and distempered their blood with a most ardent heat, that scarce one amongst an hundred that sickened did escape with life; for all in maner as soone as the sweat tooke them, or within a short time after, yeelded the ghost.

It was considered an inflammatory rheumatic disease and the loss of life in England was very great.

Influenza appeared in 1510 and spread all over Europe and the various epidemics of this disease were probably somewhat similar to the pandemic of influenza occurring in 1889 and in later years.

In the chapter upon Medical Societies and Sanitation, I have endeavored to give some account of epidemics in America; and in that upon Immunity, smallpox epidemics are discussed.

Present status of epidemics.—It is generally agreed that epidemics are very largely under control and certainly the advance of medical science largely justifies that view. Smallpox, yellow fever, malarial fevers, typhoid fever, and others, are so well understood that their control is reasonably expected. But measles, scarlet fever, and others in which the morbid elements are not defined remain a menace. The now well-established germ theory and the growing efficiency of quarantine regulations make it less likely that any communicable disease will get beyond control. And yet we do well to be sufficiently humble. Despite the knowledge of influenza, it spread all over the world in the course of my own short medical career, and I felt helpless in '89 to check the ravages of this scourge. We think we know much of tuberculosis and yet it spreads and the aggressive fight being made against it

has not yielded the results one would expect. Probably there is some essential feature concerning it of which we are still in ignorance.

Cholera recently made great headway in Russia, and the old bubonic plague appeared upon our own shores. During the Spanish-American war typhoid decimated our camps and the hospital with which I am connected was filled with sick soldiers. Several of my colleagues went carefully over one of the large camps and examined the camp hospitals. There was little to which one could take exception. Yet at that time it was not so well understood that flies carried the disease. More recent United States camps I have seen take elaborate precautions against flies. I have seen epidemic cerebrospinal meningitis and the cases died so quickly that one could but realize what a fearful mortality would result were this disease to gain headway. The foot and mouth disease of cattle has recently taught us a lesson we will not soon forget. Added to this is the possibility of new forms of disease arising. Suppose the sleeping sickness of Africa should reach the southern United States? Just to-day I read that certain scientists now believe that the tsetse fly does not originate the disease, but can contract the infection from one sick person and transmit it to another person who is well, in the same manner that yellow fever is transmitted by certain mosquitoes. Possibly we have native flies that could carry the infection.

We will do well to be ever upon guard. Our methods may be more fallible than we think. "The better part of valour is discretion" is especially true of the fight against contagion and epidemics. Immunization promises much and yet there is a danger of overconfidence. Not so long ago we thought that vaccination afforded protection for many years. We have shortened the period of protection very much. Academic arguments do not appeal to the man who constantly sees disease at its worst. He is very acutely aware of the ever present potential danger. Human bodies are the same and the germs are the same that have swept relentlessly vast hosts to destruction in the past. All that is needed is conditions favorable to the conflagration and vast epidemics may again sweep the earth. Who knows? Who expected San Francisco to burn? Do you remember the grasshoppers of Kansas? This earth has a fashion of doing unexpected things and we men are but as ants upon its surface. We are building great cities and crowding men, women, and children far worse than in any army camp. Some day we will learn a frightful lesson.

Conditions favoring and preventing epidemics.—To define these points in full would be writing a book upon pathology. Only certain features need engage us here. Ignorance is the main cause of epidemics gaining headway and poverty is its twin sister. Next to this, we must list the senseless lust for war, and last but not least the love of gain that takes all sorts of men into all sorts of places for all sorts of purposes. We call this commerce and business. In the last analysis "man's inhumanity to man makes countless thousands mourn." Ignorance means some one's inhumanity, usually some alleged government; poverty is the inhumanity of the strong snatching from the weaker brother the little share that is his; war is the inhumanity of a nation; and the greed for gold is the inhumanity underlying most of the less glittering

kinds. To abolish these things would make for the "millennium," and would almost end epidemics. We are so used to the present order of things that it is hard for us to realize that what we call civilization and progress is an aggravated case of the "survival of the fittest" that makes for destruction that may involve even the best. I am no socialist, nor do I believe in ecclesiasticism, but I do believe that, despite modern theories, Jesus taught the kind of social system that the world must adopt before it has done with epidemics and unnecessary human woe. The conditions favoring a big fire are inflammable materials and a spark. The same can be said of epidemics. These conditions are always ripe and fire departments and health departments must be ready for the quick alarm.

Conversely, the conditions tending to prevent epidemics are knowledge and education, moderate prosperity of the masses, peace and order and industrial equity. If the sociologist and the hygienist had their way this world would soon have so much wealth to divide that even the present wealthy classes would have every reason to be content with an equitable share. The waste of ignorance, of non-productive poverty, of devastating war, and of greed for money unite to produce the fearful waste of sickness and disease. The total waste of all, if saved, would pay every national debt so fast it would be hard for the governments to devise ways to spend their incomes.

Geographical considerations.—The inclination of the earth on its axis is responsible for so wide a diversity of climate that geographical location means vastly more than most persons may casually think. Elevation is another factor of more influence than would appear at first thought. Mexico, owing to its table lands, can grow somewhere within its domain every plant found upon the earth. In the summer the arctic regions produce abundantly of vegetation, and mosquitoes and the constant shining of the sun makes for surprising conditions as to heat and flora. Trade winds and streams in the ocean modify so many local conditions that mere latitude may mean but little. The protecting and moisture precipitating mountain, the great stretches of inland waters, the heat producing desert, the ozonizing forest stretches, the reeking marsh lands, and the great salt ocean all change conditions and the study of climatology is made complex. Vera Cruz was long famed for "yellow jack," and is a hot and humid port; yet sanitation has nearly freed it of its odium. Panama was long the home of deadly miasma, and the Philippines of many little-known fevers. We know what military hygiene has done for them. Nevertheless, to make the tropics healthy for white men costs much money and much work remains to be done.

To this day much of Africa and South America are a terra incognita because of endemic diseases that men fear will become epidemic in any new colony. Perhaps this fear is not so well founded as many think, for we all remember "the great American desert," and the fear to settle in what we now know as fertile land. The Maelstrom and the Saragossa Sea of the mariner may be akin to the "terrible west coast of Africa," and "the upas-cursed interior of Australia." Nevertheless, there are dangerous places upon this earth because man has not taken the trouble to intelligently study the bad conditions and remove them. Not so many years ago Cuba was our

dangerous neighbor because of yellow fever. It is not so to-day. Mysterious Yucatan was feared for its diseases until they begun to drain the marshes and build asphalt streets. Japan is teaching the Orient to kill its rats and rid the world of bubonic plague. India is regulating its religions and pilgrimages are kept in check. Mecca is regarded as of more importance when it is clean than when it was sacred, and all over the world men are learning that the rest of the world is not immune to their own dearly beloved and copyrighted kind of dirt and are cleaning up in order to get the trade of "the infidel and Western barbarian." When men learn that the earth is made to live in rather than to die in and that it is the "cosmos" and not the "gar" that the Bible says will be burned up, or, in translated words, the present organization of society and not the planet that will be destroyed, then will this good old earth that the Bible says "abideth unto perpetuity" be loved by men and be taken care of as the Creator told the first man to do. This earth is indeed a place "where every prospect pleases and only man is vile," and this latter condition is largely our own fault. The fatalism of the old theologies made man a much more hopeless proposition than he really is. If the sanitarians can wash the "heathen" perhaps the missionaries will convert him.

Trade features.—The chapter dealing with common carriers should be consulted upon this matter. There was formerly much difficulty in inducing business interests to submit to quarantine regulations, and railroads and shipping interests to disinfect baggage and freight as well as vessels and cars. The federal and state sanitary authorities have now very stringent rules upon such matters, and the reader seeking information will find it in the chapters upon quarantine, boards of health, disinfection, and corporations.

International considerations.—Practically all maritime nations have become parties to international quarantine regulations, and the weekly public health bulletins of the Treasury Department, Public Health and Marine Hospital Service of the United States, will give one some idea of the care our own government takes regarding the introduction of infection from without. But this matter is so large a subject that it must be studied at first hand to gain any proper appreciation of the matter. I have read from the reports for several years and merely wish to state that the idea of some that our naval service is maintained simply as a war measure falls far short of what the navy is really doing for the United States. (See the chapter upon Quarantine.)

"The police power."—This applies to the states and not to the federal government. The extent to which the police power may be used by the states is discussed in the chapter upon state boards of health. However, in time of peril from epidemic, state authorities may appeal to the general government for aid. This was done when the bubonic plague appeared in California. As I understand the matter, the Federal Public Health and Marine Hospital Service may intervene when an epidemic is not under control, and is becoming an interstate peril, whether they are requested so to do or not. However, the relations between this splendid organization and the states are mutually co-operative.

How to meet epidemics under ordinary conditions.—This is a matter for the local board of health. See the chapter upon such boards. Unfortu-

nately, local boards are the weak place in the system of health organization. Primarily, the responsibility is with the attending physician of the first case and the ones attending subsequent cases. The necessity of protecting the public is so great that the duty of the physician is too plain to admit of argument. The limitations of the private physician are such that he cannot know or control all of the possible sources of danger; hence, it becomes the function of the health officials, *but in co-operation with him*. The first chapter in this book and those devoted to health boards answer the possible objections to the public conduct of epidemic prevention. There are districts where there is no local board of health or where they are remiss in their duties. In such cases the physician owes a duty to the community of at least informing them of the dangers to be avoided. It takes some tact to do one's duty in such cases without giving offense.

In our elaborated civilization the facilities for preventing epidemic are so efficient that the dangers of contact contagion are so slight that an undue degree of excitement is often worked up. With the free use of antiseptics in the sickroom, frequent change of bed linen and other care common to the conduct of such cases, it is not at all likely that a mere going into the room and out again, except possibly with scarlet fever and smallpox, will carry the contagion. In twenty years' practice I have attended a fair share of the common communicable diseases, and have taken proper but not extreme care, and, so far as I know, I have never carried the disease to any one else. There is no need to alarm a community over an ordinary epidemic of the diseases of children. The newspapers are frequently at fault in giving such news items in too much detail and causing unnecessary alarm. At present some of them are making the life of tuberculous persons miserable. There is no occasion to make a Pariah and an outcast of every one with tuberculosis. Leprosy is an instance of an age-long cruelty in the name of sanitation. With all due deference to the excellent gentlemen who are enthusiastic over extreme quarantine, I wish to direct attention to the fact that a few states and some cities are unduly lengthening the list of diseases they placard. The average citizen fails to differentiate between a scarlet fever card and one for erysipelas, and may come to pay little regard to either one. In the enthusiasm of the work, some health officers have extended lists to include such diseases as pneumonia and malaria. While there is a certain element of contagion inherent to these diseases, yet the danger to the public is so slight that it is not wise to placard houses within which these and other equally limited infection is found. They may be reportable, for the sake of vital statistics, but it is a very dubious proposition to quarantine a house when they exist therein.

It is well to leave many of these minor diseases under observation jointly by the attending physician and the local health officer, for an epidemic may really result from too rigid or unwise rules, causing the community to conceal cases existing within their families and failing to call a physician at all. Especially is this true with ignorant people. Russia, for instance, enacted a law that everything containing alcohol should contain the poison label as well. Vodka, the national drink of that country, was required to bear the poison label, and it is reported that many ignorant peasants of that country drank

poisonous liquids because they mistook the poison label used for the label proper to vodka.

Epidemics in time of war.— This is discussed in detail in Chapter XII. However, there is great danger of camp and ship epidemics being spread among civilians. It is the better plan to locate camps at some distance from cities and large towns. I have seen the Provost guard have their hands very full when the camps were too close to the temptations and the vices of a city.

Special conditions and measures.— In the chapter upon state boards of health, this matter is discussed so far as general conditions may be modified by especial peril. But aside from this there are special conditions we should discuss. First of all, we will consider Anti-Mosquito Work in the Prevention of Yellow Fever.

The Anti-Mosquito Service of the city of New Orleans kindly supplied me with their regulations and reports, and from that data the following account is derived.

The service consists of a special superintendent, twenty-two inspecting and four reinspecting crews, a control crew, two oil wagons, and numerous notice servers and clerks. Special crews oil excavations and collect ladders, and the general work goes on from February to November inclusive. It costs the city forty thousand dollars a year.

City wards are used as units of work; which consists of screening, the destruction of mosquitoes by fumigation and poisoning, oiling exposed water, looking after excavations, ditches, depressions, spouting, cisterns, rain barrels, and many other conditions defined in New Orleans as "nuisances" and removable as such.

The card index system and the reports used are most elaborate, and should be consulted by any city contemplating anti-mosquito work. They would consume too much space to be reproduced here.

Foremen and helpers work under carefully worked out instructions and must be courteous to the householders, but when the owner or tenant does not screen his cistern he cannot complain when a quart of oil is poured into it. Fumigation of mosquito-infested cellars and houses is done by trained men, and in such manner that furnishings are not injured.

The work is most systematic, the workers are fined for defective carrying out of the regulations, and they are under constant supervision and control.

New Orleans to-day is practically free from stegomyia, and should yellow fever break through the barriers of maritime quarantine or elude the vigilance of the state board and reach this city through the back door, the railroads, we make bold the statement that the disease could not spread to any noticeable extent in our midst. In this assurance lies our reward for the continuous and earnest warfare waged against the stegomyia mosquito.

The success obtained in the case of this species of the insect, in fact, justifies the belief that the eradication of all varieties of mosquitoes from this city is but a mere question of time and of liberal and judicious expenditure of money.

MOSQUITO ORDINANCE

Date of Inspection
 District Inspection Report, Square No. Bounded by { Street
 ”
 By Whom Inspected { ”
 ”

Name of Street	No. of Street	Name of Owner, Agent or Lessee	How Ascertained	Name of Occupant
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Cisterns Screened			Tanks Screened			Roof Gutters and Drains		Roofs		Wells Screened			Condition of Lot			Ponds, Pools, Fountains and Urns		
Properly	Improperly	Not Scr'd	Properly	Improperly	Not Scr'd	Drained	Undrained	Drained	Undrained	Properly	Improperly	Not Scr'd	Drain- age	Holes or Depressions	Below Grade	Oiled	Screened	Fish
													Good	Bad				

Open Vaults and Cesspools		Tanks, Basins, and Sanitary Basins			Cans, Pitchers, Bowls, Boilers, Buckets, Etc.			Water Barrels		Vault or Cesspool		Occupants		Time of Entering Premises
Oiled	Not Oiled	Oiled	Not Oiled	Wigglers	Empty	Not Empty	Wigglers	Screened	Unscr'n'd	Sanitary	Condition	Constr'ct'n	W	C

WORK IN HAVANA

Colonel Gorgas kindly sent to me from Ancon, C. Z., several reprints of papers prepared by him. From one of them, "Directions with Regard to Destroying Mosquitoes," and issued from the government printing office at Washington, the following is derived:

It is known that this particular species of mosquito — the *stegomyia*, or the yellow fever mosquito — lives and breeds almost altogether in houses and in their immediate neighborhood, and does not leave the house for any great distance. With this knowledge of its life history, the department found it easiest to destroy the mosquito in its wiggler stage, and the most useful means in this direction they found to be the doing away with all the little deposits of water in and near inhabited houses, which the wiggler must have in order to develop into the mosquito. The methods herein described were not settled upon, as might appear from this account, all at once and

at the beginning, but many other methods of waging war against the mosquito were tried, found impracticable, and dropped.

With the object of doing away with the breeding places of the yellow fever wiggler all the houses and yards of Havana were carefully examined and all tin cans, empty bottles, and trash of the same kind, which were generally found filled with rain water, and full of yellow fever mosquito larvæ were carefully carted off. Then the necessary openings in all cisterns were covered with mosquito netting, so that the mosquitoes could not get in to lay their eggs. Among the poorer people, who had only barrels and other similar receptacles for rain water (and in Havana every family had something of this kind), the health department arranged these necessary receptacles for them by placing a wooden cover on the barrel, leaving a hole in the center of this cover for the entrance of water, and covering the hole with wire netting, so that mosquitoes could not get in. To enable them to draw off the water without opening the barrel a cheap wooden spigot was placed in the lower part.

Now from the peculiarity of the wiggler, that he has to come to the surface of the water every few seconds to get air, if we put anything on the surface of the water that prevents him getting this air, he drowns just as certainly as a man would who is kept under the water. Ordinary kerosene oil, a tablespoonful or two to a cistern, spreads over the surface of the water and kills the wiggler in this way. He cannot break through the scum of oil to get air. But oil very rapidly evaporates and has frequently to be renewed. So oil was only used in Havana where no other method was successful. The privy pits in all the houses there were in the center of the court, covered generally with heavy flagstone. These pits not being in general accessible to the inspectors had to be treated with oil. Once a month, a couple of ounces of oil were poured into the pipes leading to the pits.

To insure that these methods and ordinances were carried out, the city was divided into districts of about a thousand houses each, so that an inspector would get over each district in the course of a month, inspecting at the rate of about thirty houses a day. This inspector had with him two men who used the oil as above described. He had with him printed blanks on which he entered the condition of the premises as to wigglers. These reports were turned in every night to the office of the health department and were consolidated from day to day. At the end of the month we could therefore tell the condition of Havana as to wigglers. At the first report on this subject (I think in March, 1901), we found that we had in Havana in the neighborhood of 26,000 different water deposits which contained wigglers, most of them of the yellow-fever variety.

After once going over the city and carefully explaining to the people the dangers of allowing wigglers on their premises, and after having fixed up for the poor all the water barrels which they were obliged to keep for holding their rain water, the mayor of the city issued an ordinance stating that anybody who bred wigglers on his premises would be fined ten dollars. These two methods of destroying yellow fever mosquitoes, namely, that of killing the grown mosquito in the neighborhood of every yellow-fever patient with a smudge, and of looking after the wigglers in all rain water deposits about the house, were steadily enforced during the year 1901. The results were better than we had dared to hope. Few cases occurred in which yellow fever spread from a case cared for in this way. Yellow fever rapidly decreased, and on September 28, 1901, the last case of yellow fever occurred in Havana, and since that time — now more than two years — not a single new case has developed in the city.

There were still, of course, a great many yellow-fever mosquitoes in Havana, but these methods of destroying the wigglers had greatly decreased the numbers of mosquitoes. The report of January, 1902, after about ten months of this mosquito

work, showed that within the city limits less than three hundred premises had wigglers upon them. This I think a very fair measure of the results accomplished by one year's work, namely, that the number of deposits containing wigglers had been decreased from about twenty-six thousand to about three hundred.

I think it is evident that the disappearance of yellow fever from Havana was due solely to this mosquito work. Remember that it was an every-day disease in Havana, and had been so for more than a hundred years, just as consumption is in New Orleans, a city of about the same size as Havana. Now, if some method should be adopted against consumption in New Orleans, and systematically put in operation in the city against that disease, and at the end of a year it could be shown that no new cases of consumption were occurring in New Orleans, and at the end of two years and a half it could be further shown that under the continuance of the same measures the disease had entirely disappeared from the city, and no new cases had occurred, I should think that we would all be at once convinced that the disappearance of consumption from New Orleans was due to the efficacy of the measures adopted.

In Havana, even now, a case or two of yellow fever comes in every month from Mexico and other infected regions which have a considerable trade with Havana. The ships are carefully inspected by the quarantine authorities, just as is done in our country. If a person sick of yellow fever, or suspected yellow fever, is discovered, he is landed at the city wharf, in the heart of the business district, placed in an ambulance, carried to the yellow-fever hospital, which is well within the city limits, and treated there. The only precaution taken is to see that Havana mosquitoes do not get an opportunity to bite him. The authorities at Havana thoroughly believe that if they can prevent mosquitoes from biting a yellow-fever patient the city will be entirely safe in handling him and taking care of him.

YELLOW FEVER AND MALARIA IN THE CANAL ZONE

The Republic of Panama enforces the following regulations:

YELLOW FEVER

Section 12. Whenever a case of yellow fever is reported to the health officer, it shall be his duty to cause the case to be removed to the hospital, or other building, provided for such cases.

The following rules are to be observed in caring for yellow fever patients:

(a) Those in care of the sick shall see that, at all times both day and night, the bed occupied by the person sick is completely enclosed by a mosquito netting, so as to make it mosquito proof. The windows and doors of rooms occupied by the sick must be screened with mosquito netting.

(b) The health officer shall cause to be screened such other rooms in the house as he may consider necessary for protection against mosquitoes. Any person removing, breaking, or otherwise injuring these screens, so as to disable them from keeping out mosquitoes, shall be deemed guilty of a violation of these rules and regulations.

(c) The health officer shall see that all the places in the house, yard, outhouses, or places connected with the house, where mosquitoes may breed, are rendered proof against mosquitoes, and all persons living in the house must use such care and watchfulness that in the part or parts of the house occupied by them, no water in jars, bottles, cans, hollow place in floors or yards, or any place or article in which water may collect, is allowed to remain.

(d) On the termination of the case, or after its removal to the hospital, the health officer shall cause to be made a thorough and careful fumigation of all rooms in the house where the case occurred, and if in his judgment it is necessary to protect the public health, neighboring houses shall also be fumigated.

As is well known by physicians, yellow fever has been practically eliminated as a dangerous factor in the Canal Zone. See the list of papers referred to in the chapter upon State Boards of Health, under "Canal Zone," and to which the reader is referred. The methods used paralleled those employed in Cuba.

As regards malaria, the problem varies. Again let me quote Colonel Morgas, from a reprint sent to me:

But malaria on the Isthmus and malaria at Havana are very different problems. Malaria in a big city is principally a disease of the suburbs; and as the breeding places for anopheles are not very extensive in the suburbs of a large city, the work of eradicating these breeding places is not so great a problem. And even when anopheles are bred, only a small part of the human population is infected; so that a good many mosquitoes will bite before one happens to strike an infected individual, and thus get the contagion. While our efforts at Havana were not directed particularly against malaria, the same work that destroyed the yellow fever mosquito at the same time destroyed the malaria mosquito; and we practically eliminated malaria from Havana without particularly intending so to do, by the same works that got rid of yellow fever — simply the destruction of the breeding places of the anopheles mosquito.

But on the Isthmus I find conditions very different. We have a long line of canal with twenty odd villages and some twelve thousand people scattered over a length of nearly fifty miles. We find that most of these twelve thousand people are capable of conveying the contagion of malaria to any newcomer who comes to live among them. By actual microscopical examination of the blood of several hundred of these people, we find that over seventy per cent have the malarial parasite circulating in their blood; and this on a single examination. The percentage would probably be very much higher if we made a second or third examination of the thirty per cent who are found uninfected at the first examination.

This means that practically every female anopheles mosquito that bites a human being along the line of the canal becomes infected, and our examination has further shown that there is no lack of anopheles mosquitoes. I suppose it is no exaggeration to say that any man who spends a night in one of these villages will contract malaria.

Our examinations have further shown that the kind of parasite discovered in these cases is not the parasite of the ordinary chills and fever, known as the tertian and quartan, but the parasite that causes the deadly chagres fever, known as the estivo-autumnal parasite. Probably eighty per cent of the infected individuals examined were infected with the chagres or estivo-autumnal parasite. This will give you some idea of the conditions as to malaria which we are attacking.

Our plan along the canal is, in general, as follows: To eliminate all possible breeding places for anopheles near villages or dwellings along the canal. This we expect to do principally by superficial drainage. As you see in going over the railroad, we have already made considerable headway in this direction. I think any one who has never tried it would be surprised at the effect a little work around an unhealthy locality will have in doing away with the different species of mosquitoes that are night travelers, such as the stegomyia and anopheles. Ancon Hospital, which six

months ago was a pretty bad mosquito locality, is almost entirely free. At my own quarters I scarcely ever see a mosquito.

We are also going to try to do all we can towards freeing the inhabitants along the line of the canal at present infected from the contagion. We are establishing, as rapidly as we are able, dispensaries at various points, under the charge of competent physicians, who will treat natives and endeavor in every way possible to get them to take quinine regularly.

By these two methods, viz., by decreasing as much as possible the number of malaria-bearing mosquitoes, and, on the other hand, by decreasing as much as possible the number of instances of malaria-infected natives, we hope to bring it about that when the large influx of laborers comes to the canal there will not be so general a malarial infection among the newcomers as there was among the French, for instance, in the days gone by.

If in Havana, by mosquito work alone, we practically succeeded in eliminating malaria, or if at Ismailia, on the Suez canal, under the advice of Dr. Ronald Ross, by mosquito work alone, malaria was entirely stamped out, I feel very confident that, by the two methods combined, we ought to have a considerable degree of success at Panama. If, on the one hand, we could get rid of every anopheles along the line of the canal, and, on the other hand, cure every human being of the infection, we would surely be entirely successful and have no malaria at Panama. While in all probability such complete success is not possible within any short time, we will approximate this idea of a perfect condition just in proportion to the amount of labor and money we are willing to spend in the attempt. Personally, I approach the problem with great hope of success.

Other special conditions.—Our limitations as to space preclude a description of the methods for ridding Puerto Rico of the hookworm disease, the Philippines of cholera, and the Pacific coast of bubonic plague. However, the chapter upon Slums and Town Nuisances and the regulations regarding shipping (see General Index) as well as “California” in the chapter upon State Boards of Health, all discuss bubonic plague. See also “Puerto Rico” in the same chapter. (See Index for hookworm disease.)

Osler’s “Modern Medicine” discusses at length the several tropical and other infectious diseases not indigenous to the United States and that we will not undertake to discuss in this book except under Shipping and Harbors, in Chapters XXII and XXIII. All of these special problems are somewhat beyond the province of the civilian physician, but the physicians of the army and navy are creating quite a literature thereon.

When to apply for state aid.—It is impossible to give here a categorical answer to the questions suggested by this heading. The chapter upon State Boards of Health discusses the matter, and the several states are taken up and some outline given of their regulations. Physicians and sanitarians must be guided by the laws of their own state. See also the chapter upon quarantine.

As a matter of fact, many of the states are prepared to do a great deal in case of epidemic, and it is becoming quite common for the state to have especial provision made for the meeting of the financial obligation involved in fighting epidemics of disease. Every local board of health should realize its limitations and promptly notify the state officer of threatening conditions. It is never safe to wait until the infection is widespread. We have excellent

regulations in Pennsylvania for epidemic work. Local registrars and the division of vital statistics are in constant touch, and when threatening conditions arise, the county inspector and very likely a state inspector goes at once to the point of danger. The division of engineering has sanitary surveys of all portions of the state in their offices, and these maps intelligently guide the army of men placed upon the work. The machinery is so well organized that an epidemic is policed by trained men within a day or two of the conditions becoming threatening. Several other states follow somewhat similar plans.

"*Shot-gun quarantine.*"—It is very easy for the present generation of young doctors to criticise this kind of quarantine, but the men who remember the fright of the Southern states over every fresh outbreak of yellow fever feel a wonderful relief that this sort of thing is no longer necessary. However, "shot-gun quarantine" never was as bad as some paint it. Here are the old regulations of Mississippi:

MEASURES TO BE TAKEN WHEN A TOWN OR LOCALITY REQUIRES TO BE QUARANTINED

32. If the inspection of a town in which yellow fever exists does not show that all foci of infection, possible fomites, and persons liable to develop the disease are under observation ("in quarantine"), or if such occur which cannot be traced to any known focus, such town shall be quarantined.

33. Quarantine line must be defined by the health officer in charge, who shall employ a sufficient number of guards, at a salary of \$1.50 per day, who shall be on duty from 12 M. until midnight, when they shall be relieved by a like number for succeeding service. He shall also employ a competent man, at \$2 per day, to act as captain of the guard, whose duty it shall be to be present at all guard mountings, and to exercise such supervision over them as to insure efficient service, keeping a correct account with each guard. He shall make a daily report of the names and time to the health officer in charge. He shall also appoint two immunes, at a salary of \$2 a day, whose duty it shall be to bury the dead, as provided in rule 38.

34. No person or thing of any kind whatsoever shall be permitted to pass the guard line without a permit from the health officer in charge.

35. *Relay stations.*—All train crews from an infected town, making regular stops in this state, and communicating with non-infected localities, must be changed, and not allowed to have direct communication with clean territory. This should be done at a non-infected place, as isolated as possible, a siding rather than a station, and certainly not in a town. Every man of the train crew, mail agent, expressman, Pullman crew, and train "butcher" must make this relay.

None of the merchandise of the train "butcher," except disinfected newspapers. No possible fomites shall pass the relay to the clean crew, nor shall communication between the two crews be allowed. The relay must be under the supervision of a sanitary officer.

The plan for relay stations set forth in the diagram furnished by the Mobile & Ohio Railroad is endorsed.

36. All practicing physicians within the quarantined locality shall report to the office of the health officer in charge by 9 A.M. each day all cases of yellow fever seen by them during the twenty-four hours preceding this, applying, however, to cases not previously reported.

37. No train, cars, or locomotive carrying passengers or freight shall stop or come to a halt within the quarantined locality without permission from the health officer in charge.

38. Permits must not be honored by the guards when more than twelve hours old.

39. Persons dying with yellow fever, when practicable, must be buried within six hours after death. The body must be wrapped in a sheet, previously saturated in a solution of bichloride of mercury one to one thousand. Not more than twelve persons shall be allowed to accompany the body to the grave. The coffin or casket, having been closed, shall not be reopened, and, as soon as removed from the room where death occurred, the room shall be closed and not opened until ready for disinfection, which shall be done as soon as practicable. The room and contents shall be disinfected as herein provided.

40. Any infectible town or community having communication with an infected town or community will be considered as infected, and therefore in quarantine.

Abandoned measures.—What immediately precedes this is an instance of abandoned measures. Inoculation for yellow fever is another instance of a discard. It is quite probable we will soon see the present means for treating sleeping sickness abandoned in favor of screening the patients. We all know the advances in the hygiene of tuberculosis. Other diseases are being studied and modern methods being evolved for their prevention. This sort of study will influence the conduct of epidemics. Perhaps other pet theories will go. We should all be in a receptive attitude.

Federal aid.—Chapter X discusses many phases of the problem. Chapter XII discusses what the army and navy are doing. Chapter XIV upon quarantine gives additional data. The Pure Food and Drug Act is treated of in Chapter XXI. The latter portion of Chapter XXII discusses infected immigrants. All of these matters have a bearing upon federal aid in case of epidemic.

Savage countries.—Savagery begins at home. Just what constitutes a "savage nation" is hard to define. We have our conventional notions of the proportion of killing, of eating, of religion, of law, and of other primary matters. One proportion makes a savage; the same things, in different proportion, constitute "civilization." After all, ignorance is the basis of savagery. All the world was savage until a portion learned better. Europe five centuries ago was more savage than is the interior of Africa to-day. Wholesale massacres in the name of religion would not be tolerated anywhere on earth now except in some of the "civilized" countries. This chapter tells of the dancing mania of the middle ages. Some time since, I was asked to conduct a religious service. I was told that "Mother ——" was present and, after a few mild remarks, I introduced her. She greeted the congregation of ignorant slum dwellers with a literal whoop and started to insult the Almighty with as disgusting a performance of cant and jumping around and generally disturbing the peace as I have ever seen. I immediately left the platform and watched the rumpus from the rear. Before it quieted down, the whole mob was shouting and hysterical. I very much doubt if the dancing of the middle ages could be of a worse character. I have also seen religious dances among Southern negroes that were of a similar character to those of

the middle ages. Hysteria and essential savagery prevails among the low and ignorant classes just as much as it ever did. In a former location I practiced extensively among a community filled with one of the peculiar German denominations and their superstitions and beliefs belonged to the very dim past. Sanitation among those people was tinctured with so much mysticism and dogmatic ignorance that the ancestor worship of China, that prevents railroads touching the millions of graves that dot the land, is mild by comparison. And the absolute sanitary degradation of some of the slum dwellers (and the wealthy owners of the hovels) need school for the first and jail for the second class. No wonder we have epidemics and we will continue to have them until it is a crime to purposely debase one's fellowman. Or, in other words, until savagery is abolished in the United States. So far as the so-called "savage nations" are concerned, we have only to look at the Sandwich Islands, New Zealand, and the Philippines to learn that, given the "square deal," most of these sidetracked "savages" turn into reasonably good citizens in a very short time. We have less to fear from them, so far as epidemics are concerned, than from the civilized traders that go among them.

The march of trade.—What is said upon the sanitation of railways and steamship lines, in Chapter XXIII, gives the distinctly practical side of this question. The ethical argument is not for us, but is of great importance. Indirectly, it influences sanitation when a nation has correct ethical conceptions.

"*The white man's burden*" is partly sanitary. It impresses me that as shipping profits from harbors and as railroads profit from the development of the country through which they run and iron works profit from the railroads and the merchants profit from all, and so a commerce is developed, it would not hurt these "interests" to be taxed for the purpose of making these alien countries safe places in which to do business. The same people are taxed at home for these purposes. Why not tax them in these new countries they are exploiting? The United States helped Cuba to clean up and be placed in a sanitary state, and it has paid us to do so. Why can't England and Germany and France and other strong countries come to the help of places more or less looking to them? Epidemics would not be so frequent were this the policy of the nations.

Camp epidemics are discussed under army and navy hygiene.

The outlook looks encouraging enough. But I fear that the sanitarians are too optimistic. Epidemics are not frequent in so long an interval of comparative peace. The world has been fairly prosperous and famine has been very limited. But we do not know what is ahead. A long war, some great national calamity, failure of crops over a large area. Many things can happen. Disease has not lost its power and epidemics are still possible. The general practitioner as well as the sanitarian have their responsibilities.

CHAPTER XVIII

DISINFECTION*

Chemical data — Directions for the use of approved disinfectants — Sulphur — Formaldehyde — Mercuric chloride — Minor disinfectants — Steam — Boiling — Specific examples — The patient — Disease notes — Nurses — Dangers.

IT must not be forgotten that the term “disinfection” means the process of *destroying* the disease-producing bacteria. Hence, this chapter does not deal with mere antiseptics and deodorants, although an antiseptic (if used in great concentration) may be a disinfectant, and the latter may deodorize. Stevens classes as germicides or disinfectants the following chemicals:

Mercuric chlorid.

Phenol

Cresols

Creosol

Guaiaicol

Resorcin

Naphthalen

Betanaphthol

Salicylic acid

Benzoic acid

AROMATIC SERIES

Benzene derivatives of coal-tar products.

Formaldehyde

Urotropin

Silver compounds

Chlorin

Bromin

Sulphurous acid

Hydrogen dioxid

Potassium permanganate

Lime

This is a conservative list and other drugs might be included in the same classification, but even all of these are not really of service in the work of the sanitarian.

In practical application some other chemicals are used in carrying out the details of disinfection, while other less active disinfectants are not used.

The present writer has practically tried out most of the methods in modern use and has rejected all of the generators and most of the apparatus formerly so largely in use. Simple methods are far better and nearly all of the practical work of to-day is done by following the general methods to be outlined. The state boards of health of nearly all of the states issue directions to their health officers as to the details of disinfection. What I will have to say is based upon my own experience, and data derived from a careful analysis of the means published by the several boards. Particularly do I wish to make acknowledgments to the boards of Louisiana, Iowa, Ohio, Pennsylvania, Wisconsin, Virginia, Nebraska, and Indiana.

*Compiled from health board literature.

The chemicals used should be fully up to standard, and it is well to give specifications concerning them. From variously derived data I would suggest the following basis for purchasing:

Sulphur.—The “roll” sulphur containing ninety-eight per cent absolute sulphur is to be preferred. It should be broken into pieces only as used. It is found in the market in packages of about five hundred pounds.

Formaldehyde.—The U. S. P. Liquor Formaldehydi meets all requirements. The liquid must be clear and free of sediment and of a specific gravity not below 1.075 at twenty-five centigrade, and the residue from evaporation should be of a white color and disappear completely when ignited. It comes in glass carboys of one hundred pounds or more.

Potassium permanganate.—It should be ninety-nine per cent pure, as designated in the U. S. P. Much commercial permanganate is of this strength and will serve every purpose. The small crystals are to be preferred for rapid evolution of formaldehyde gas. It comes in kegs of about one hundred and fifty pounds.

Mercuric chloride.—Need not come up to U. S. P. requirements, as a salt ninety-nine per cent pure suffices for the work. It should be free from color. It is commonly marketed in wood containers of twenty-five pounds.

Ammonium chloride.—Select the granular form of ninety-eight per cent purity and free from color.

Ferrous sulphate.—Select that in small crystals and of ninety-five per cent purity. It comes in wood containers of three hundred pounds.

Crude phenol.—That distilled at from one hundred and sixty-five to one hundred and ninety centigrade.

Phenol (carbolic acid).—Use phenol liquefactum of the U. S. P.

Cresol.—Use the U. S. P. liquor cresolis compound, “creolin,” or “lysol.”

Chlorinated lime.—Give preference to that in powder or granulated. It should contain thirty per cent of chlorine and not over ten per cent of moisture. It is usually packed in cases of ten cans of five pounds each. Liquor sodæ chlorinatæ (1 part to twenty of water) may be used, but costs more.

Other chemicals.—Good commercial grades.

Disinfection must be adequate or it is worse than useless, because it gives a sense of false security. It is just as harmful to half way disinfect as it is for the fire department to half extinguish a fire. Surgeons learn the lesson of sepsis and it is to be feared that many other physicians but half way learn it. These latter men are liable to depend upon utterly inadequate disinfection, with weak solutions or with weak proprietary “disinfectants.” It is of the utmost importance that the chemicals used be of good quality, and the data given are of value in determining whether they are or are not of standard grade. It is also of importance to use them in proper strength and the following directions are to be depended upon.

Sulphur.—Burn not less than four pounds for every one thousand cubic feet of air space. Keep room closed for twenty-four hours. Sulphur burned in a dry air is of very slight disinfecting power. First, prepare the room by opening out clothing and bedding, pulling furniture from the walls, loosening

prints and photographs on the walls, opening and suspending by their covers all books and pamphlets, pillow slips removed and hung on a line, pillows turned on end, mattresses placed in good position, closets and dressers opened and emptied, registers shut, and all cracks and openings closed with rags or pasted shut with strips of paper.

Procure a tub and fill in a few inches of water, sufficient to nearly cover four bricks placed in the center. Upon the bricks place an iron pot or pan and break the roll sulphur into it in rather small fragments. Now take a hand atomizer and spray water around the room and over most of the objects therein, pour alcohol over the sulphur and light it, see that it is well on fire and that all is safe from fire spreading to surrounding objects and then close the door and seal it with paper from the outside. After twenty-four hours, air out the room.

If the furnishings in the room are of such a nature as to be injured by spraying with water, boil a kettle of water in the room so that it is filled with steam or pour a quantity of boiling water into a tub and allow the steam to escape into the room.

Sulphur disinfection is only fairly effective, and it must not be forgotten that metal objects and gilt frames are liable to corrosion by the fumes and that wallpaper and fabrics may be more or less bleached. Sulphur candles are effective if one uses a sufficient number of them, something very rarely done, since it takes nearly a dollar's worth to disinfect a moderate-sized room.

Formaldehyde.—Prepare the room as for sulphur disinfection. Be sure the air is moist, and it is well for it to be quite warm also. For each one thousand cubic feet capacity provide two pints of formaldehyde solution and thirteen ounces of potassium permanganate. This is a safe amount, but some authorities require less. The Virginia State Department designates about the least of any state, viz. twenty-two ounces formalin (twenty per cent) and nine ounces potassium permanganate. Indiana and Ohio are instances of states designating the larger amounts. Iowa provides formalin, twenty ounces; potassium permanganate eight and one half ounces.

Following a list suggested by the Iowa Board, it impresses me that the greater quantity should be used for disinfection following cholera, bubonic plague, epidemic cerebrospinal meningitis, diphtheria, scarlet fever, smallpox, chickenpox, tuberculosis, typhoid fever, typhus fever, erysipelas, and puerperal fever. A smaller quantity, even one half of full quantity, will suffice for disinfection following measles, mumps, whooping cough, and minor infections. At retail drug store prices, the full quantity of formalin and permanganate will cost a householder about one dollar and fifty cents.

After the room is prepared, procure a tin, agate, or iron pail holding not less than eight quarts and place it in a large dishpan, with two bricks under the pail and within the pan. This is necessary because of the heat generated and the effervescence when the chemicals are mixed. In very rare instances there has been fire from the heat or ignition of the vapor, but with proper handling this should not be. It may be well to look through a window while the gas is being evolved. Allow no fire or light in the room.

Place the *permanganate in the pail first*, and when all is ready from a

wide-mouth bottle or a pitcher quickly pour the formalin upon the crystals, and quickly retreat from the room, closing the door promptly and sealing it from the outside. The sealing should include the keyhole and the opening for the knob. Do not open the room for at least eight hours. Ventilate thoroughly and then close again, with several shallow vessels containing a little ammonia distributed through the apartment. This will soon remove the odor of formaldehyde. Then open again and allow the sun to enter if possible.

This method is the most effective one known and has very little effect upon metal ornaments and upon fabrics. Some of the claims made regarding the penetrating power of formaldehyde gas have not been justified by experience, but the agent is one of great value when properly used. (See also Chapters XI, XII, and XXIII.)

Mercuric chloride (corrosive sublimate).—A solution of one to one thousand (sixty grains to one gallon of water) will kill pathogenic bacteria, excepting anthrax, in fifteen to twenty minutes. When much organic matter is present twice this strength is required. Always use a fresh solution and do not keep it in metal vessels nor pour quantities through metal pipes. In making large quantities of solution, ammonium chloride may be added to render the bichloride more soluble. The city of New Orleans designates one and one half ounces each of bichloride and ammonium chloride to twelve and one half gallons of water (about five bucketfuls) to make a solution for disinfecting clothing and bedding. The garments are immersed for six hours and then rinsed in clean water. The Ohio Board uses the following “standard solution”:

Corrosive sublimate, four ounces.

Sulphate of copper, one pound.

Water, one gallon.

The copper salt is added principally to color the solution. For disinfecting stools add eight ounces of the stock solution to one gallon of water. One half this strength is suitable for disinfecting clothing, towels, bed linen, etc. Immerse them in it for several hours before sending to the laundry. Read what is said in Chapter XXII concerning sewers and pouring “disinfected” stools therein.

Another good stock solution that keeps well has been adopted by the Iowa Board. It is as follows:

Corrosive sublimate, three hundred thirty and one half grams.

Citric acid, one hundred and fifty-six grams.

Water (soft), twenty liters.

A little coloring material.

One ounce of this solution to one pint of water makes a solution of one to one thousand. It is suitable for many purposes.

Ferrous sulphate.—Bulletin No. 15 of the United States Hygienic Laboratory demonstrates very fully that this agent (formerly much depended upon) is not efficient as a disinfectant. It possesses slight antiseptic properties and is used more or less, but cannot be depended upon. If it has any real place, it is to suppress offensive odors from vaults and even for that

it is inferior to chloride of lime. *Copper sulphate*, in five to ten per cent solution, is useful to disinfect stools.

Crude phenol is no longer official, but it is very cheap and is used for disinfection of stables and places where the odor is not objectionable. The Wisconsin Board recommends for stable and cellar disinfection a solution made of equal parts of crude phenol and concentrated sulphuric acid.

Slowly add the sulphuric acid to the phenol contained in a vessel immersed in water. Use the mixture by diluting with water so as to make a two or three per cent solution for use upon smooth surfaces and five per cent upon the rougher places.

Phenol U. S. P.—A five per cent solution (phenol, eight ounces; water, five quarts) is a good general disinfecting agent and especially for sputum. For use upon the human skin do not employ solutions over two and one half per cent.

Cresol of the U. S. P. is not well adapted for disinfection until after it is saponified. "Creolin" is such a product but, despite the claims of its maker, is quite poisonous, although not so corrosive as is phenol. It is employed in the strength of from one ounce to a gallon up to very much stronger solutions. "Lysol" is a fifty per cent creolin preparation and may be used up to two per cent upon the skin and five per cent upon discharges.

Chlorinated lime.—Use six to eight ounces to a gallon of soft water and keep in a stone jug or jar. The stronger solution may be used for receiving feces and the weaker one for other discharges. The contact of the disinfectant should not be less than half an hour and the amount of solution used at each evacuation should be at least one quart. For disinfecting bedding, clothing, dishes, etc., use one to two ounces to a gallon of water and allow them to remain in the solution for several hours.

Fire is a sure disinfectant to be used for things of little value.

Steam.—Superheated steam under pressure (240 degrees F.) will destroy all germs within ten minutes. It requires apparatus in a special building. The general practitioner will not have to do with this method, but every municipality should have a plant so arranged as to secure good pressure and with the steam chamber built into a brick wall and the two ends opening into unconnected rooms, one for infected articles and the other for disinfected ones.

Dry heat.—An oven at a temperature of 230 degrees F. will disinfect articles therein after an exposure of two hours.

Boiling in water for thirty minutes will destroy all germs.

In a public health sense, "Complete Disinfection" means disinfection during illness of the patient's body (superficially) and all of the secretions; clothing and utensils used by the patient, and after recovery, death, or removal, disinfection of all apartments (and their contents) occupied by or contiguous to the patient. It should be done by the local health officials during and following dangerous infectious diseases inclusive of tuberculosis.

By "Partial Disinfection" is meant the disinfection of the discharges or excretions, the clothing of the patient and the room used by him, after his recovery. This may be done by either the attending physician or by the health officials.

SPECIFIC EXAMPLES

Room fumigation has been sufficiently discussed under sulphur and formaldehyde fumigation.

Room disinfection may be otherwise accomplished (in part) by washing all metallic surfaces with formalin solution and all non-metallic surfaces with bichloride solution, as already designated. Be careful to reach window ledges, crevices, and out of the way places. The walls should be carefully gone over. All carpets should have been removed from the room before the patient was put there, but if they were not removed, mere wiping with a solution will not suffice, and they should be disinfected under superheated steam or by formaldehyde. Floors must be scrubbed with soap and hot water, after the designated solution of chlorinated lime has been applied to soft spots or bad places in the flooring.

School disinfection.—If infectious cases have been found in a room, thorough formaldehyde fumigation must be employed. In the absence of such cases, half strength formaldehyde disinfection is adequate. Be especially careful of books. Balustrades and door knobs should be regularly wiped with cloths wetted with a solution of formaldehyde or of phenol. Infected books had best be burned. *Churches and public buildings* should be disinfected in the same manner.

Stables and cellars.—Read what is said under crude phenol. A boiling hot four per cent solution of common washing soda is useful in cleansing stalls, stairs, etc. Lime washing is of value. Manure heaps should be covered with milk of lime freshly prepared.

Car disinfection.—Bulletin No. 27 of the United States Hygienic Laboratory details a series of experiments made in a Pullman car under varying conditions. It was determined that the degree of both heat and of humidity in the car should be about sixty-five, otherwise the disinfection is imperfect. Owing to the fact that a car has so many windows and doors, the amount of formaldehyde should be great and the car should not stand in the wind while being disinfected. It is best to use a greater amount of chemicals than is directed for an apartment in a house. (See Chapter XXIII.)

Boat disinfection.—This subject is discussed in Chapters XIV and XXIII. It is done principally at government quarantine stations.

Cabs, hearses, etc.—Remove cushions, curtains, and accessories, and disinfect with formaldehyde, in a small room or closet. Wash other non-metallic parts with bichloride solution and the metal parts with a cloth wetted with formalin.

Pet animals.—Wash with soap, in hot water containing four or five per cent phenol. "Camphenol" serves the purpose very well.

Privy vaults.—They are an abomination and should be treated as noted in the chapter on Rural Hygiene or abolished altogether. It is impossible to fully disinfect the contents, but the danger may be minimized by regularly applying milk of lime. It is readily made by adding water to quicklime and turning over the mass until it is pasty and smooth. It should be freshly prepared. Iron sulphate is utterly inadequate for the disinfection of a vault.

Chloride of lime is useful if a sufficient quantity is used. As a matter of fact, no vault can be fully disinfected until after it is emptied of its contents. It is then an easy matter by using chlorinated lime, milk of lime, copper sulphate, or the crude phenol. Use solutions as already designated.

Water closets, urinals, and sinks.— Never place infected matter in them. Cleanliness, good plumbing, and continual application of disinfectants will keep them in safe condition. To disinfect contaminated ones chlorinated lime is probably as effective as is any other chemical.

Doorways.— Some of the proprietary antiseptic makers have advocated the hanging of sheets or blankets saturated with their preparations, in doorways. Some persons place saucers of chlorinated lime in the sickroom, or keep towels saturated with solutions of phenol. It takes very little thought to realize how futile such methods must be. Beside that, it worries the patient. The *right* thing to do is to use adequate ventilation. *Fresh air* in almost unlimited quantities is worth more in one day than these trifling methods are worth during a whole sickness. However, there are occasions where the air from the infected room may be kept from other rooms by hanging in the hall door or the doorways of other apartments, cotton blankets that may be wetted with *strong* disinfecting solutions.

Washable articles.— Read under mercuric chloride. Also, one can use formalin (four ounces to each gallon of water) and allow the articles to remain in the solution for one or two hours.

Unwashable articles.— Burn useless ones. If there is a municipal disinfecting plant, have them subjected to superheated steam. Formaldehyde fumigation in a closed room is effective.

Stored articles.— When clothing and small articles are packed away after the case is over, it is well to first secure a tight box or trunk and place oilcloth in the bottom, and upon it spread a towel or cloth saturated with formalin. Then, loosely fill in the articles and close the container for a day. Next day air the articles and pack them away.

Bodies of persons dead from infectious disease.— The American Public Health Association and the American Association of General Baggage Agents have adopted rules governing the transportation of the dead. As relates to disinfection the requirements are:

Rule 2. The bodies of those having died of diphtheria, scarlet fever, glanders, anthrax, or leprosy shall not be accepted for transportation unless prepared for shipment by being thoroughly disinfected with

- (a) Arterial and cavity injection with an approved disinfecting fluid.
- (b) Disinfecting and stopping of all orifices with absorbent cotton, and
- (c) Washing the body with a disinfectant, all of which must be done by an embalmer, holding a certificate as such, approved by the board of health.

After being disinfected, as above, such body shall be completely wrapped in a sheet thoroughly saturated with a strong solution of bichloride of mercury, in the proportion of one ounce of bichloride of mercury to a gallon of water. Then follow other rules as to less dangerous diseases, airtight caskets, etc.

SPECIFIC EXAMPLES — THE PATIENT

Disinfectant bath.— During illness use solution phenol, not over two and one half per cent. Alcohol one fourth to one half strength. Strong solution borax. After recovery bathe patient in bichloride solution (one to four thousand) followed by a plain soap and water bath.

Stools and sputum.— In case of typhoid, cholera, dysentery, scarlet fever, diphtheria, tuberculosis, etc., the stools, urine, and expectorated matter should be disinfected at once. Use solutions of chlorinated lime or phenol, as already designated. Dejecta and solution should be in equal volumes and the vessel should be covered for an hour or more before being emptied. Before pouring into any drain, pour boiling water upon the disinfected contents of vessels. If buried in the earth, dig down at least one foot and never near a well or cistern.

Wash water that has been in contact with the patient or the hands of the nurse should have disinfectant added before pouring out. Copper sulphate serves well and the water should stand for one hour.

Soiled rags and cloths should be promptly burned.

Rejected food and drink must not be eaten by others. Burn the solid portions and place liquid with the dejecta and disinfect.

Thermometers and other appliances used in the sickroom should be placed in three per cent phenol solution.

Stained spots on clothing should be immersed in the following solution: phenol, three parts; tr. green soap, ten parts; water, one hundred parts. Keep in solution for two hours and wash in warm water.

Soiled spots on body may be washed with Labarraque's solution, one to five of water, on skin; one to ten, on mucous membranes.

Gargles and sprays are numerous and their composition will depend upon circumstances. It is well to use them in most infectious cases.

Medicated oils possess little disinfecting power, but are useful in case of desquamation.

Toss sticks and vapor lamps merely deodorize and cannot be depended upon for any purposes of disinfection.

DISEASE NOTES

Smallpox.— Provide a separate room for the physician, in which he can make changes of clothing and disinfect exposed surfaces with the solutions already given. They should use a washable gown, gloves, and cap. Rubber boots are also advised. After each visit sprinkle these garments with four ounces formalin and roll into a compact bundle. The most absolute quarantine and disinfection regulations should be observed from the beginning to the end of the case. All counties and municipalities should provide a contagious disease hospital and all cases of smallpox should be removed thereto.

Diphtheria.— Remember that diphtheria germs in dry dust retain their vitality for a long time. Enforce the disinfection already described, being especially careful of all discharges and even vomited matters. All linen *must*

be disinfected and nothing should go out of the sickroom except it is placed in proper solutions at once. All inmates of the dwelling should have an immunizing dose of antitoxin.

Scarlet fever.—Rigid rules of disinfection are absolutely imperative and especially of discharges from the mouth, throat, nose, and the desquamation from the skin. Look out for mild cases both in children and adults and for “scarlet rash.” Disinfect the stools. The recovery or death of the case should mark the most absolute disinfection of the premises of possible attainment. Especial care should be used to disinfect the hair and scalp of every person under quarantine.

Measles.—This disease is contagious even before the rash comes out and early precautions are necessary. Take especial care of throat and nasal discharges and of the skin.

Whooping cough.—Give plenty of fresh air. Contagium does not carry far. Use mild disinfection. Vapor lamps of doubtful value.

Chickenpox.—Mild disinfection of patient.

Mumps.—Better confine patient to one room and use mild disinfection.

Typhoid fever.—The most rigid care of all excreta. Be especially careful to exclude or kill flies. All linen, table ware and rejected food must be disinfected. Well persons should eat nothing in or from the sickroom. Hand disinfection is of great importance.

Puerperal fever.—Much of this disease spells criminal negligence upon the part of doctor or nurse. Rigid asepsis in midwifery is imperative and adequate antisepsis if fever occurs. Attending physicians should employ every possible means of personal disinfection before attending another case of labor.

Ophthalmia neonatorum.—The instillation of two per cent silver nitrate solution, or at least of saturated boric acid solution, is demanded. One is safer in using the silver salt.

Tuberculosis.—Rigid disinfection of sputum, skin, clothing, linen, and apartment. Of stools, in intestinal forms.

NURSES

The Pennsylvania and some other state boards of health have issued contagious disease bulletins for nurses. All nurses should procure some such publications or make a study of the excellent textbooks prepared especially for them. Physicians owe it to the nurses to warn them of any personal danger. For instance, while a physician may conceal from others the fact that a babe has ophthalmia neonatorum, he has no right to conceal it from the nurse caring for the child. We should look to it that we protect our nurses and, with those not fully informed, lay down rules for their own protection when nursing typhoid and other cases.

DANGERS OF DISINFECTION

There is some danger from fire in both sulphur and formaldehyde disinfection, but care in using the processes suggested will practically eliminate such dangers. Corrosion of metal is a danger, since pouring bichloride solution down drain pipes during a long sickness has been known to so corrode the pipes as to cause leaks of either water or sewer gas. Such solutions may be poured into sewers, provided the solution is diluted and fresh water is allowed to flow after its passage. Bichloride will ultimately inflame the hands of persons making constant use of it.

All poisons should be labelled, as required by law in many places. Nearly all disinfectants are poisonous and great care should be exercised with them. After the purpose for which they were used is at an end it is well to destroy or bury the portion left. All physicians and nurses should know the antidotes for the poisonous chemicals used in disinfection. They are as follows:

Formaldehyde — dilute spirits ammonia. Evacuate stomach.

Potassium permanganate — evacuate stomach, repeatedly siphoning out with water. Give white of egg and stimulants.

Mercuric chloride — emetic and siphoning out stomach with albumin water. Then give milk and eggs and siphon again. Follow with milk in some quantity and stimulants. Morphine for pain.

Phenol, etc. — Siphon out stomach with water and alcoholic liquors. Be careful no damage is done by tube. Even half strength alcohol may be used, but it should be siphoned out in a few minutes. Vinegar and white of egg are of some value. After evacuation, give a solution of sodium sulphate or any soluble sulphate, and keep patient on gruels. Keep the extremities warm. If blood pressure falls, give atropin hypodermically. If respiration becomes oppressed, give inhalations of amyl nitrite.

Chlorinated lime — Labarraque's solution, emetics, siphon out stomach with quantities of water containing a trace of ammonia. Give raw white of egg and stimulants. Opium for pain.

Copper sulphate — Same as mercury salts.

The disposition of poisonous solutions should be such as to preclude their entrance into wells or cisterns. Never allow solutions to stand around in small vessels where they are apt to come within the reach of children.

Proper disinfection requires some skill. Health officers may be better informed upon the matter than is the physician in charge. Some physicians do not seem to realize the distinct limitations of many of the agents often depended upon for disinfection. A sulphur candle or two, a small formaldehyde generator, a weak solution of the chlorides, some over-exploited proprietary preparation or some antiseptic not classed as a disinfectant; all of these lull us to sleep in the presence of imminent danger. The books of twenty years ago are no guide in disinfection to-day. New agents are in the field and it is quite necessary for physicians to inform themselves concerning them. Inadequate disinfection is seldom excusable in this late day.

There is no claim for originality or novelty as regards the matters presented in this chapter, but every effort has been made to maintain accuracy and to recommend efficient and dependable methods tried out by myself.

BE SURE YOU GET GOOD CHEMICALS.

BE SURE YOU USE ENOUGH.

NEGLECT NO DETAIL.

TAKE NO CHANCES.

WHEN IN DOUBT, TRY AGAIN

CHAPTER XIX

TUBERCULOSIS SANATORIA AND DISPENSARIES*

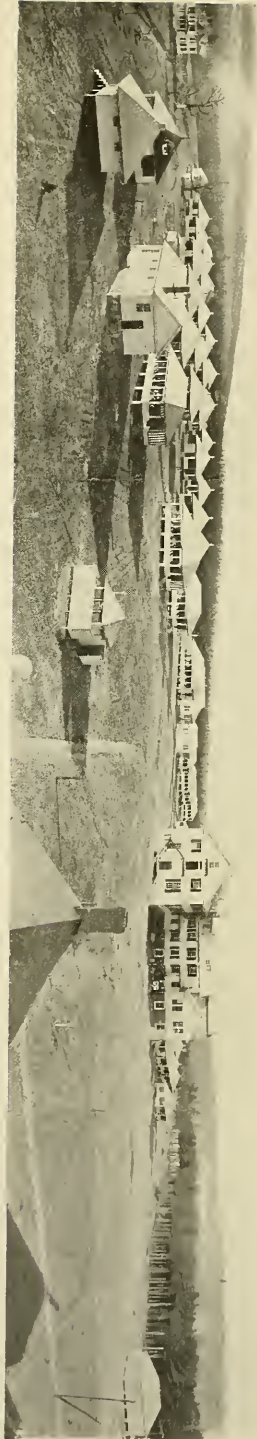
THE present writer realizes that current literature has recently been so filled with articles upon this subject that it will not reflect upon his interest or knowledge to make this paper somewhat brief.

The fresh air propaganda.—The marvelous advance in medical science during the last quarter century is nowhere better exemplified than in the management of tuberculosis. Less than a century ago, the consumptive case was given whiskey and cod liver oil and usually a hopeless prognosis, and there was a great fear that good air from open windows would kill him. To-day profession and public alike realize the fallacy of such treatment, and it is a strange commentary upon recent times that the ancients probably all knew of the advantages of fresh air in the disease. The rank medicament of oil and its accompaniments are done away with because of their disturbing digestion. Whiskey is less used since accurate scientific tests reveal the fallacy of expecting from it the beneficial actions imagined by the fathers. Fresh air is regarded more and more favorably and is practically agreed upon as a most necessary portion of the treatment of our cases. There may be theoretic objections, but the present fact that the tubercular are now recovering under the fresh air treatment, whereas they formerly died, brushes aside at once all objections to the reasonable and rational employment of fresh air in treating this disease. Naturally, there have been enthusiasts who have overdone the fresh air treatment and advised risky procedures for infants and aged people, but the general procedure is so thoroughly justified in the practices of both the general practitioner and the attendants at state and private institutions that we feel justified in saying that fresh air in tuberculosis is no longer a debatable proposition.

The realization of the fact that a large proportion of tuberculous cases can and do recover has led to a great change in the attitude of the medical man toward this disease. When consumption was regarded as incurable the doctor shrank from telling his patient or even admitting to himself the unwelcome diagnosis; whereas we now seek to discover the presence of the disease as early as is possible, since the earlier the recognition the more probable the cure. Our profession has caused these changes in the general attitude toward the disease. As with smallpox, cholera, malaria, yellow fever, and many other diseases that were formerly very prevalent but are now largely under control, so the physician has taken a new and more optimistic view as regards tuberculosis, and the public have come to know that this destroyer will soon be listed among the diseases under control.

Fresh air, good food, abundant rest, and an upright and well-regulated life are the factors in the cure of this disease when curable and to restrain its ravages in cases too far advanced to be susceptible of absolute cure. But no

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DAY PAVILION

DIXON COTTAGES

DINING HALL

matter how advanced the disease, these means added to judicious medication will render far more comfortable the erstwhile hopeless and depressed sufferer. We have referred to fresh air, but wish to add that proper clothing is necessary. In high latitudes, the element of cold adds one good feature and one bad one. The good one is that the atmosphere is more condensed in cold weather, and it is estimated that there is one seventh more oxygen to a given amount of air in winter than is found in summer. This helps to warm the body and maintain proper tissue combustion and elimination. It is a matter well recognized that the tuberculous patient must be warmly clad in winter or in a cold climate. The bad feature in cold weather is that an extra amount of stress is imposed upon the body to keep up a proper temperature. This can be overcome largely by a proper apparel and a dietary directed to the production of body heat. It must be admitted, however, that aged persons, those unaccustomed to a cold climate and certain advanced cases all do better in a more southern climate, but not a tropical one. On the other hand, there is too much regard to mere temperature upon the part of some patients and their physicians, and the general impression among experts is that proper clothing and protection largely offsets the disadvantage of mere reduction of temperature.

In the discussion of "Heating and Ventilation," in Chapter XX, there are several points made that apply to the problem in the treatment of tuberculosis. Adequate ventilation without refrigeration *is* attainable in hospitals and sanatoria in the far north. The question of clothing is more of a local one than might appear upon the surface. Woolen clothing seems to be essential in the far north, and yet the wool grown there is harsh and very uncomfortable to a tuberculous person. He better procure his woolen clothing from a more southern source. Wool has its disadvantages, and it is a really remarkable fact that the porous knit linen underwear is excellent protection against the cold. Its disadvantages is high price, lack of durability, and the necessity for great care in laundering. The cotton fleece fabrics are well adapted to the tuberculous if of sufficient weight.

Food for the tuberculous.—It is generally admitted that an albuminous and a largely animal dietary is essential to the cure of tuberculosis. The egg and milk diet has been so largely discussed in the medical journals and recent books that little need be said here. So much enters into the question of diet that a book upon public hygiene cannot be expected to discuss fully what is so well stated in literature more especially directed to the subject. A hundred and one details concern the practical forced feeding with milk and eggs. Doubtless some enthusiasts have unwisely used them in certain cases, but there are many physicians who turn from the method too quickly, and before they have learned the limitations and the practical advantages of proper feeding with milk and eggs. Many patients imagine they cannot digest milk and eggs, whereas there is no real basis for their belief. Patience and judgment is necessary with this, as with every therapeutic or dietary list or measure. Some authorities are inclined to the view that a phosphatic element in the diet of the tuberculous is of great importance, and there is a growing tendency to allow more of a mixed diet than was the case early in the

propaganda. The chapter upon "Rural Hygiene" gives points concerning milk and eggs that are of interest in this connection. It is becoming more definitely proven that alcohol is of no value to the tuberculous and there should be little if any indulgence in tobacco.

The proper role of drugs.—Medicines are of undoubted value in the symptomatic treatment of the disease, and may at least give ease to many distressing features of a specific case, just as they do in other diseases. And yet drugs without the means already mentioned would fail to cure our patients. On the other hand, the one who relies upon these means and ignores drugs will also fail. Both means are valuable and each should be used. A specific cure for the victim of tuberculosis has been sought long and assiduously. Again and again has the claim been made that it has been found; just as often has the claim been proven fallacious. But with courage undaunted, with faith unshattered, we continue the search and now believe that success is near, for the new specific for which we look is not some rare drug. Well-trained workers are now seeking an antitoxin that will neutralize or overcome the poison generated by the growth of the tubercle bacillus. This general line of research is discussed in the chapter upon "Immunity."

State sanatoria.—The federal government makes slight provision for the tuberculous at the hospital at Fort Stanton, N. M. (See the chapter upon "Army and Navy Hygiene," which shows what a full general work is done for the soldiers and sailors. Also read the special section upon "Immigration Inspection.")

The Sharon Sanatorium in Massachusetts (1890) showed that consumption could be treated successfully in the low altitudes and in the damp, variable climate of New England. This institution was made possible by contributions from private citizens of Boston. It accepts as patients only women of limited means and who are in the early stages of tuberculosis. It makes a charge of five dollars a week, furnishing board, medical service, and medicines.

Its success inspired the state of Massachusetts to provide for its own consumptives within its own domain. In 1895 the state legislature appropriated the sum of \$150,000 for this purpose. Ground was purchased at Rutland, about eleven hundred feet above sea level, and the erection of a suitable building was begun. Additional buildings have been made available, until now the institution presents a most imposing appearance and provides three hundred and fifty beds. It accepts men and women in the early or moderately advanced stage and charges five dollars a week.

The state general hospital at Tewksbury has a group of buildings separated one half mile from the main structures and devoted to the care of tuberculosis work devolving upon it. Its one hundred beds are open to all stages of the disease, to both sexes, and makes no charge.

Many other states have followed the example of Massachusetts. New York state has a multiplication of resorts where the tuberculous may secure skillful treatment. It has excellent systems of dispensaries, day camps, and sanatoria accomplishing a very effective work in which it separates the incipient, the moderately advanced, and the seriously advanced cases, and the

cases are promoted or demoted as their several degrees of development may render necessary. The state hospital for the treatment of incipient cases of pulmonary tuberculosis is situated at Ray Brook, Essex County, in the Adirondacks near Saranac Lake and at an elevation of sixteen hundred and twenty-five feet. It has one hundred and twenty beds and is designed for the poor citizens, but, when there is room, will also admit those who can pay.

The constituent parts of greater New York, as the borough of Manhattan, borough of Brooklyn, etc., all have sanatoria maintained by the separate municipality or by the help of the greater one.

The state of Pennsylvania has many sanatoria within its borders. The Free Hospital for Poor Consumptives (1901) is located at White Haven at an altitude of about fifteen hundred feet. It has two hundred beds, accepts men and women, but only in the early stages, and now is obliged to charge from seven to nine dollars per week, much to its regret. The very active state department of health is making a very comprehensive effort to lessen the ravages of tuberculosis. Each county has a medical inspector, whose duty it is to preserve, so far as he can, the health of his constituents. The sixty-seven counties are further divided into seven hundred and thirty-three subdistricts, each in charge of a health officer, who co-operates with his chief, the county medical inspector. The Pennsylvania dispensaries serve as feeders to the Pennsylvania State South Mountain Sanatorium (1907) and is situated near the Maryland line at an elevation of about fifteen hundred feet.

Incipient and moderately advanced cases are placed in small cottages, each one of which has four bedrooms and a common dressing-room. Each chamber has two single beds and is provided with two large windows and communicates with the dressing-room. These cottages were designed by Health Commissioner Dixon and are intended for night use exclusively. During the day the patients are expected to rest in one of the pavilions which are open on all sides, except the windward one, except in time of storm. During suitable weather, patients are encouraged to walk in the open air, but extreme exposure is avoided. Meals are served in a large dining-room that will shortly accommodate one thousand patients. Incipient cases are kept separate so far as is practicable.

Advanced cases are treated in an infirmary located a mile distant from the cottages. Here the ward plan is used. These cases will be classified as soon as is possible and the races and sexes are strictly separated at present and have been from the first. All service is free to citizens of Pennsylvania so long as the legislature keeps up its present generosity. The water supply is carefully guarded from contamination by covering the springs and conduits, while the sewage is conveyed to a point a mile from the camp, where it is sedimented, filtered, aerated, and chlorinated before it is permitted to escape as a beautiful, clear stream of water. It is expected that ultimately three thousand patients will be accommodated. A practical duplication of this institution is contemplated nearer the western end of the state on the high summit of the mountain near Cresson.

Maryland has established its state tuberculosis sanatorium on the mountains near to the Pennsylvania line, and but a few miles distant from the Pennsylvania institution already described. Its Administration Building is a handsome structure, built of stone from the immediate vicinity. Of similar design and connected thereto is an infirmary accommodating twenty patients. The present structures form the frontage of a parallelogram, the side lines being arranged in frame shacks for incipient cases and shaped as a letter T; the dressing-rooms, lockers, baths, etc., being in the stem and the beds in the long cross-bar. There are ten beds in each division and with a window to the rear of each bed, which looks to the north. There are windows in the ends of these wards. To the south the wards are enclosed with large sash windows which can be so lifted that the ward becomes open in this direction. At present (late in 1909) there are eight of these T buildings completed, but more are being added.

This institution is for curable cases of tuberculosis that may be found among the white citizens of the state. There are now twenty free beds, but most of the patients are expected to pay at least three dollars per week.

Michigan, Iowa, Indiana, the District of Columbia, Minnesota, Missouri, New Hampshire, New Jersey, North Carolina, Ohio, West Virginia, and Wisconsin are illustrative of states recently establishing state tuberculosis sanatoria, while many other of the states have taken the initial steps or are planning the erection of such institutions. Admission is usually limited to residents of the state and is secured through the health authorities. The chapter upon "State Departments or Boards of Health" gives much additional information.

Private and semi-charitable sanatoria.—This class of institutions preceded those established by the states. Dr. Edward Trudeau was the pioneer in this country. He established in the Adirondacks, about 1885, the first sanatorium for the treatment and cure of consumptives. His method has been careful dietetic management of the individual patient and an observance of good hygiene. He encouraged his patients to spend many hours in the open air. The bitter cold of the Saranac Lake region in the winter season did not terrify him; he merely shielded his wards from the wind and warmly clothed his patients. His great success has inspired very many others to follow his example. A few of these ventures have been too largely marked by commercial instigation, but the greater number are honestly conducted, although lacking the professional skill and thorough equipment of the more noted private institutions. The medical directories give lists of these small sanatoria all over the United States.

Camps.—During the early months of the propaganda in favor of the outdoor life for the tuberculous, everybody seemed to become imbued with the idea that the cure consisted merely in camping out. The real workers did not advocate so easy a program, but the newspapers invented the cult of the tuberculous to the manifest advantage of the tent-maker. Any one who takes the trouble to read the reports of the medical service of the army and navy or who has visited an army camp will soon see the disadvantages of the tent.

The tent soon evolved into the "shack," or floors and sides of wood or a blue top were added to the tent and practically made a shack of it, to its manifest improvement. Such frail structures are now more used in the South or during the summer months, but the large pavilions are used in the winter. In an institution, where proper medical advice is available, these structures fill a very useful place, but the untrained layman is apt to take up the fresh air treatment as a sort of fad and may make very unwise use of tents and other frail shelters. It is always wise for organizations of laymen who provide such shelters to submit each case to a physician who is practically informed as to the proper methods to employ in the various stages and phases of tuberculosis, or to employ a physician to look after all of the cases so generously cared for by these organizations. There are many well-planned sectional or knock-down houses, window tents with the body of the patient indoors, and elaborated tents that, properly used, are ideal. But it must not be forgotten that the smoke and vapor-laden air of the industrial sections of our cities cannot be made to take the place of pure country air. While climate is not so great a factor, *clean air* is of the utmost importance. Under "Camps," in the chapter upon Army and Navy Hygiene, and in the remarks upon contractors' labor camps at the close of the same chapter, much is said that applies here.

Home care.—This is a work upon public hygiene and not one upon treatment of disease. Hence, we feel that it is unnecessary for us to elaborate upon the home care of the tuberculous. The modern works upon the practice of medicine do that more effectively than the limitations of our present space will permit. And yet we feel that it is a matter of extreme importance that the medical attendant upon the cases of tuberculosis treated in their homes, and they constitute a great majority of all cases, owe it to their patients, the community, and to themselves to thoroughly inform themselves upon the details of such lines of treatment. If you have not already done so, brothers, *do it now*. We know that you are busy, and that the world is moving very rapidly these days, but the writer is a general practitioner himself and it is not mere enthusiasm, but our clinical experience, that prompts us to say what we have said.

How to get patients into the sanatoria.—This matter has been already touched upon, but permit the writer to urge all to read the chapter upon State Departments and Boards of Health. He will there find much information. The procedure differs in many states, but your local board will be in position to supply all information applying to your own state.

Dispensaries.—Many cases of tuberculosis occur among the poor who are unable to employ a competent physician for the conduct of a long case or to carry out his recommendations. Others, by reason of illness, become almost as helpless as the former class. To aid these sufferers and to protect the community, dispensaries have been organized in nearly every large community and in not a few smaller ones. Sometimes these institutions are supported by the state. Again, the municipality or local societies bear the burden of expense. However they may be supported, they are valuable factors in the campaign against this disease. They should be educational

centers, from whence knowledge may be disseminated throughout the community. This educational influence is not for the public alone; physicians who serve upon the staff naturally become better diagnosticians; their colleagues, who at intervals visit the dispensary and study the patients, likewise become more skilful in recognizing the disease. When several physicians study the same patient, each probably gives and receives some valuable information.

Patients may here be taught how they should live, that they will not be a danger to their associates. They should be instructed concerning the disposal of sputum, the necessity for admitting air and sunshine to their homes, that they must keep their surroundings clean, that they must take at least nine or ten hours of rest every day, and that alcoholism, immorality, poor food, and bad air are allies of the disease.

The nurses connected with the dispensary frequently devote a portion of their time to visiting patients at their homes. They supplement the instruction given by the physicians, by practical demonstrations; they open doors and windows, clean the rooms, teach the proper preparation of food and in a hundred other ways render efficient help in the fight.

The nurses also send to the dispensary such relatives of the consumptive as have been exposed to the infection, thus leading to an early recognition of those who may be attacked. Through these influences much is done to help the sufferers and more is accomplished in the prevention of the disease.

Better results may, however, sometimes be secured through the sanatoria. In these institutions the patient is under better control and he is frequently stimulated to greater effort through the influence of others who are waging a similar fight. Some persons think the discipline is rigid, but a short residence at one of them should convince most any physician that it is necessary. On the other hand, the results are so visible to the persons following up the cases and one will find very few indeed of the workers but who are enthusiastic advocates of the system.

Many states issue excellent tuberculosis leaflets and provide free lectures and other educational features as well as traveling exhibits. Several well-equipped institutions are making a thorough study of tuberculosis, and it is to be expected that great advances will have been made within the next few years.

Climate.— This matter has been touched upon in several places in this book. (See the General Index.) From complaints received it seems to be a great error for physicians to send advanced cases of tuberculosis to Colorado and New Mexico, where not only are advanced cases not benefited, but where, through lack of means, they are apt to become a weight upon the several communities in which they settle and die.

Advanced cases are not suitable for either the dispensary or the sanatorium and should not be sent to either place. The fresh air cure is too late for the most of them to be at all worth while, although any level-headed physician should be able to devise a compromise course of treatment suitable to each individual case. It is mere cruelty to subject these hopeless cases to the rigors of the treatment entirely applicable to younger or more incipient cases.

After the sanatorium it is not at all safe for the apparently cured case to presume too much upon the solidity of his lungs. He must still live a rather rigid life and should be under the care of his physician.

CHAPTER XX

HOME HYGIENE AND INTERIOR SANITARY INSTALLATIONS*

Sanitary building and repairing — The grounds surrounding the home — Alleys — Domestic animals — Paving and walks — Vegetation — Flies — Mosquitoes — Dust — Closing the home in summer — Summer homes — Garbage — Furnishings — Cleaning — Walls and floors — Water supply — Heating and ventilation — Gas installations — Electric installation — Sanitary plumbing.

THIS chapter involves so many problems that frequent references will be made to other portions of this book as, to keep within limits, matter must not be repeated. Furthermore, what is said within the bounds of this chapter will, as instanced under the heading "Sanitary Plumbing," involve larger questions than those embraced in a private residence.

Sanitary building and repairing.— The questions embraced in the sanitary construction of the various classes of buildings is so large a problem that whole volumes are written upon the construction of single types and to cover the whole field would be an immense task. In the Appendix at the end of this volume, a short essay upon "Sanitary Construction" tells what is of interest to a physician in so far as *new* work is involved. Chapter II, upon "Hotels, Lodging Houses, and Public Buildings," and parts of Chapter VII, upon "Slums," and Chapter XXII, upon "Public Works," give additional information.

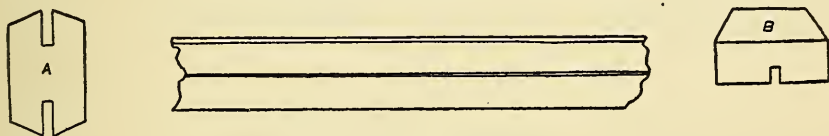
Repairing is more commonly done in an insanitary manner than is new construction. It is amazing how much filth accumulates in the cracks and crannies of a building. When a workman is making repairs, it is not to be expected that he will take the time and trouble to clear out the uncovered dirt. That it should be removed goes without saying. Our building laws need more supervision of such matters, and owners and contractors should be required by law to remove and to properly dispose of all débris and filth dangerous to public health. In the absence of such regulations, owners should follow up all repair work and see that dirt is not boarded up again.

Many repairs commonly made are insanitary and mere reference to some of them will suggest to the thoughtful reader the fertility of this subject. Laying a new floor over a rotting or filthy one; covering mossy old shingles with a tin roof; building a cupboard or closet around old plumbing apt to leak or sweat; doing away with gas fixtures and allowing the useless pipes to remain connected up, thus risking a leak in the future; changing plumbing in such a way that one trap may "suck out" the seal of another one, leaving dead ends in sewers to save the trouble or expense of removing the rejected portion; hanging new wall paper over old; using soft brick where water is apt to seep through; ventilating sewers into chimneys to save the cost of extending the "soil pipe" up through the roof, etc.

*Heating and Ventilation, by William G. Snow. Gas Installations, by Allen S. Graham, A.B. Other subjects by the editor.

When one buys an old house, a thorough sanitary survey should be made before one begins the repairs he may contemplate. An important matter in repairing an old house is to shut out rats and other vermin. It is estimated that the board bill of rats and mice in the United States is about ten million dollars a year. Add to this the damage to property and the bubonic plague they produce, and the total damage runs to very high figures. Tight walls and good connection with the sewage pipes will keep them out. In California large sums of money are being spent to accomplish this end. Modern concrete construction puts an end to rats in many buildings. Warehouses and grain bins need especial protection.

The grounds surrounding the home.—In the chapter upon “Rural Hygiene,” this subject is dwelt upon in its larger phases. A few points need emphasis as regards the city backyard. Adequate drainage is the most important matter. Storm water should be carried away at once and that demands sewers as a rule. Mosquitoes will breed amazingly fast in a poorly drained yard. The constant effort should be made to keep down the growth of moss and fungi in a shaded yard. Worms, slugs, and other creatures tend to multiply in the city backyard. I keep a land turtle in my yard and it eats these vermin and picks up little bits of meat that may escape the garbage can. Too many vines and an excess of vegetation is unhealthy in a



PHILADELPHIA FENCING

(A) is a locust post roughly-finished and deeply gained upon both sides so as to receive a one inch board. The portion going under ground is not finished or gained.

(B) is a top rail or finish, gained to fit over a one inch board, and made of about the same width as are the posts so as to drain water off the tops of posts.

The boards used may be flooring or six-inch boards tongued and grooved and beading down the center. All material should be surfaced upon both sides.

In construction, place the posts at a proper distance to cut the boards to advantage. Push the boards down the gained grooves and fasten at the top with (B). Do not nail boards, and only slightly nail (B) to tops of posts.

When the lower boards rot out, remove (B) and break out rotted boards, pushing upper ones down and supplying new boards at the top. This fence should be well painted.

small yard. Cleanliness is essential and every city should provide proper collection of garbage and trash from backyards. I fear that the æsthetic features of some of our city yards serve to conceal vices in hygiene. Fences should be well constructed. A high board fence should be avoided, but when needed, the so-called Philadelphia fencing is to be preferred, because it is alike upon both sides, is smooth and the rotting base can be removed and

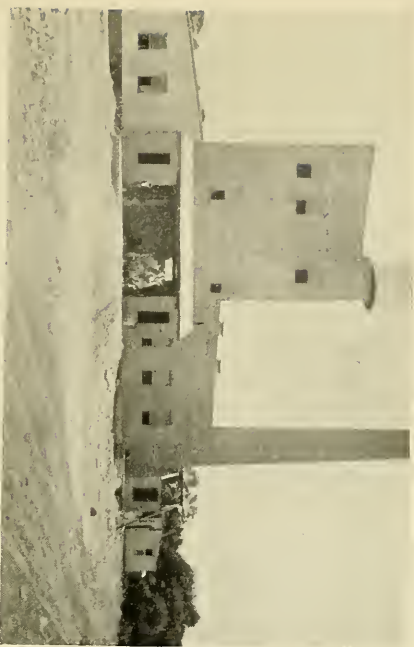
the higher boards pushed down and new ones slipped in at the top without tearing down the panels. When it is not necessary to obstruct the view, iron or wire fencing is preferable.

Alleys.—From my observation, I believe the only way to keep an alley clean in the city is to pave it and have it regularly swept, just like the streets. That is the way we do with our alleys here and they are swept once or twice every day, quite eliminating the menace of the alley. From a financial point of view, it pays; and it certainly does from the standpoint of hygiene. Alleys with houses built upon them attract better tenants when they are paved, and if they are lined with stables it is very difficult to keep them clear of manure and refuse unless they are paved.

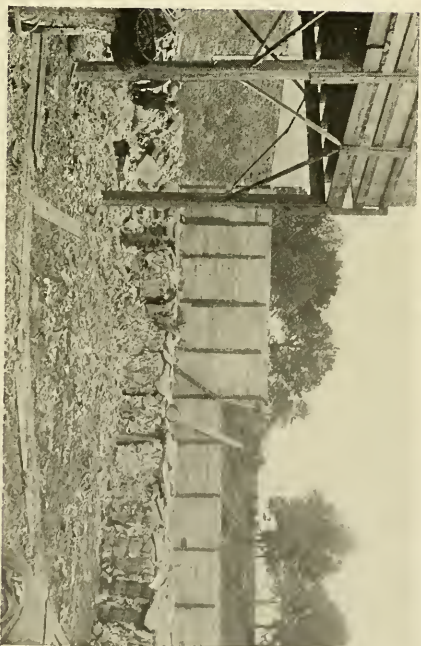
Domestic animals.—Unless an animal is well kept one has no right to keep it at all. Nearly all cities (see the chapter upon Local Boards of Health) have ordinances regulating the keeping of animals and imposing more or less restraint upon them. Cattle need space and care that it is almost impossible to give them in the city. The question of milk supply (see the chapter upon Rural Hygiene) is too important to allow cattle to be kept in an insanitary manner. If cattle are kept within too constricted quarters, they are very liable to develop tuberculosis, and small yards are no place for them. Dogs are not only roving animals, but they are quite subject to disease if kept too closely confined. The house is no place for them, and unless one has suitable quarters for the housing of a dog, one should not be kept. Cats are peculiarly liable to contagion and are apt to carry it when cases exist under the same roof. Keeping hogs, chickens, etc., in small yards should not be permitted. It is unhealthy for the human inmates of the adjacent houses, but contagious diseases, in addition, are liable to develop among the confined animals and poultry and spread among their own species. See the Appendix for a description of these diseases.

Paving and walks.—Cement or “granolithic” paving is the most water-proof and not at all liable to become covered with moss, hence it is the best form for placing next to the walls of houses and in areas and shaded yards. Vitrified brick comes next to it in this regard, and if cement grouting is run into the interstices, it makes a very good substitute for cement.

Vegetation.—Trees should not be too much crowded nor be placed too close to the house. Vines are open to more or less objection upon sanitary grounds. If very close to a house and in a shaded place, they are apt to harbor mosquitoes and other insects and large vines are used as roosting places by English sparrows, and they foul the roof and walks and carry in all manner of trash for nest building. Too many bushes and large plants are objectionable in a small yard and care should be taken in raising poisonous plants in yards to which children resort. Some very common house plants are poisonous. The oleander is quite toxic, the primrose may or may not be toxic, depending upon the species. Many of them will produce a rash upon the skin of persons handling them. The daffodil and the hyacinth are somewhat poisonous, the bulb of the latter being especially so. The ragweed should never be allowed to grow in the yard nor upon adjacent vacant lots.



CONCRETE CRIBS CONNECTING WITH STORM-WATER
SEWER PREVENTING FLOODS IN LOW LANDS
A GARBAGE DISPOSAL PLANT



AN EXPOSED SEWER POLLUTING A RIVER ALONG
A CITY STREET
BAILING RAGS AND PAPER AT A NEW YORK
DISPOSAL PLANT

Flies and mosquitoes.—Other portions of this book dwell upon these insects as carriers of disease, the fly especially disseminating typhoid fever, and the mosquito malaria and yellow fever. Door and window screening largely keep them out of the house, but every householder should see to it that they are not developed upon his own property. The chapter upon "Rural Hygiene" discusses both of these pests, but a few cautions especially apply to the town. Flies are propagated chiefly in manure and the proper disposition of that substance and the erection of proper closets and outbuildings will largely prevent their development. Mosquitoes hibernate in cellars, and it is well to burn sulphur in the cellar once or twice in the early spring, closing it up tightly during the fumigation. See the chapter upon "Disinfection." Standing or stagnant water should be emptied out. Even the part of the sewer that carries only storm water may breed mosquitoes, and if there is no rain for some time it is well to pour a little coal oil into these sewers where the down spouts discharge into them. If a room is badly infested with mosquitoes, sulphur fumigation will kill them.

Dust.—This is the bane of the house wife, but cannot be entirely prevented. The chief aim should be to keep the dust from becoming contaminated with actively harmful objects. Dried sputum from a tuberculous case is the worst thing one can get into dust, but anthrax germs and those of scarlet fever are nearly as bad. If one follows the rules given in this book as regards quarantine and disinfection, there will be little liability of such dust transmission so far as the home is concerned. Moulds will dry and their spores constitute an important portion of the dust of a room. Good housekeeping will not permit moulds to thrive.

Closing the house in summer.—This is bad for the house and for its furnishings. Before leaving the house a survey should be made of the whole premises. It is well to turn off electric light main switches and turn off the gas at the meter, and see that the plumbing is in good condition. It has been suggested that one pour a small amount of a hydrocarbon oil into all traps and commode seals to prevent evaporation of the water and the escape of sewer gas. Moths and vermin can do an immense amount of damage during one's absence, and they should be carefully looked after before closing the house. When the house is opened again it should be well ventilated and thoroughly cleaned.

Summer homes.—The chapter upon "Rural Hygiene" covers nearly all of the points involved. The urban dweller who has a country home should investigate all of the sanitary questions involving the neighborhood and not take it on faith or by hearsay. He has too much at stake to do so. The experiment some are making of living in tents or semi-tents during the summer does not agree with all persons. The knockdown houses or sectional houses are better, and one can live quite comfortably in the larger ones. It is always safest for one to take a good and large size filter to their country home. Read what is said upon rural resorts in other chapters.

Garbage.—Garbage disposal plants are in common use in the cities, and the regular collection of house garbage, kept in proper receptacles, solves the

garbage problem so far as the city is concerned. Where the garbage is not fed to the hogs, it is a good plan to bury it regularly. Even in that event, the galvanized containers should be used, since the garbage is well covered from flies and does not give rise to odors.

House furnishing.—There is a growing tendency among persons of good taste toward simplicity in house furnishing. Elaborate hangings and upholstery is not favored as formerly, while iron and brass bedsteads and mission furniture is in favor. Rugs which are readily shaken, few draperies, and sanitary furniture go far toward the comfort of the home. A good sanitary refrigerator that is readily cleansed, good laundry tubs, and other stationary plumbing fixtures, a good range and sanitary beds and bedding,—all these go further to make home comfortable than does any amount of mere ornamentation. We are learning from the Japanese and other orientals the beauties of simplicity. There is yet room for improvement. Simplicity in house furnishing will give the homekeeper more time to cultivate the mind and take outdoor exercise for the benefit of the body; all of which tends toward the improvement of the race.

House cleaning.—The old plan of tearing up the house for the annual house cleaning is, happily, going out. Hardwood finishings, rugs, simple furniture, improved methods of cleaning, and many other factors are uniting to keep the house always presentable and vastly more sanitary. Nevertheless, millions of our people have not gotten away from the old ways, and many cannot because of the expense involved. But every one can make a beginning by deciding that, as carpets wear out, they will fix up the floors, and that they will buy better furniture and less of it. By pursuing such a plan the home is practically reconstructed within a few years.

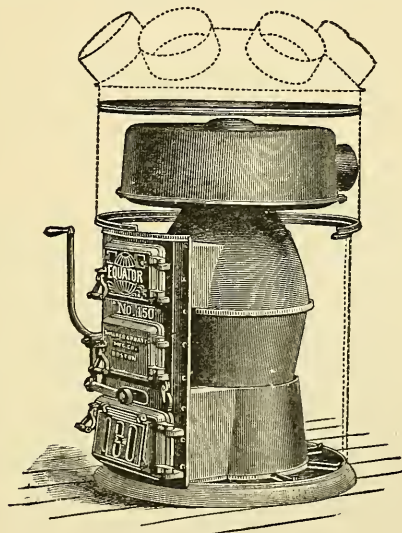
Walls and floors.—The hard cement plaster now used has done much to render walls sanitary and it seems a mistake to me to cover such walls with paper. Paint or alabastine is to be preferred, or when wall paper is used, the varnished paper is to be preferred, especially in kitchens, bathrooms, and children's bedrooms. In case of contagious disease, this glossy paper is readily wiped down with bichloride solution. Most of the dealers do not carry in stock a good selection of these papers, but they are made in many attractive patterns. I find it the best wall covering for my laboratory of anything tried thus far. Gilt papers are often ruined by sulphur and other fumigation, and the felt papers are porous and hold dust and mould very readily. Floors are discussed in the Appendix in an article upon sanitary construction. Waxed and oiled floors require much attention to keep them clean. I am inclined to think that they are often kept too smooth and glassy. I like a painted floor, but the floor paints offered are nearly all of disagreeable color and are too glossy. If the tinting is done by the householder and made to harmonize with the color scheme of the room and the paint is thinned with turpentine, a nice floor results. The large and the portable vacuum cleaners take the dust out of floor coverings nicely, but the manufacturers of these devices could improve upon them by devising an attachment that will adequately remove dust from a hard finished floor.

Water supply.— This subject is discussed pretty fully in Chapter VIII. Sanitary plumbing in this chapter gives data upon the subject, and filtration is presented in Chapter XXII.

*HEATING AND VENTILATION

OF the older methods of heating, the fireplace gives the maximum amount of ventilation combined with the minimum amount of heat in proportion to the fuel burned. While highly desirable as adjuncts to modern heating methods, the scarcity of wood, the high price of coal, and the inconvenience render this method out of the question for the complete heating of dwellings and other buildings.

Heating by fireplaces was superseded by stoves, giving a maximum of heat with a minimum of ventilation.



HOT AIR FURNACE

Later came the furnace, which is practically a stove without a casing, the space between the two being supplied with air taken preferably through a cold air box connected with the outside air. This method of heating is a compromise between the fireplace and the stove, giving a good supply of fresh air and fairly good efficiency. To-day this method is used chiefly in smaller dwellings, although many large residences are equipped with furnaces having combined hot water attachments for supplying rooms too remote to be supplied successfully through a hot air pipe.

*By William G. Snow, Heating and Ventilating Engineer.

As to disagreeable odors from furnaces, these come chiefly from particles of dust coming in contact with highly heated surfaces. The fault really is in having too small a furnace for the work. Were a larger one used in a given case, the air would not be heated to a sufficiently high temperature to cause trouble from this source.

The gas complained of from furnaces does not, in the writer's opinion, commonly come through the castings or joints, but is more likely to escape around the feed door to the cellar and thence pass up around the furnace pipes or be drawn in through faulty joints in the furnace casing.

The air supply to furnaces should be taken from a point well above the ground if possible. As a rule, it is desirable to keep the cold air box through the cellar above the floor, as underground ducts are apt to become damp and mouldy or form pockets in which water will collect.

While it is desirable to use only outside air, there are certain sections of the country where the climate is so severe that it is almost the universal custom to return at least a portion of the air from the house to the furnace through a return air register. The great objection to this is that in order to save coal people are likely to use the return air altogether, shutting up the cold air box and cutting off the fresh air supply.

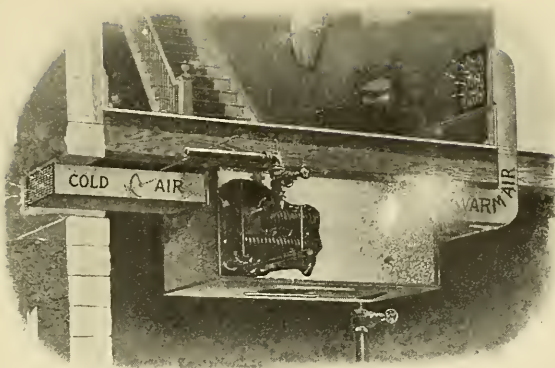
Small school buildings are often heated by warm air furnaces which afford a very good method. Larger buildings are sometimes heated by furnaces, but these have to be located at various points in the basement to avoid long runs of pipe, and are, of course, less convenient to operate than are steam-heating systems with one or two boilers.

Furnaces used in combination with fans are sometimes installed in schools, churches, or public buildings, thus permitting the placing of the furnaces in a single battery, the fan overcoming the resistance to the air flow in long ducts.

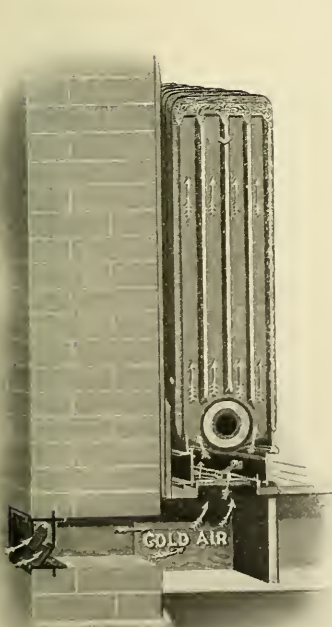
Of the more expensive methods of heating, direct steam is perhaps the most commonly used. This method corresponds more nearly with stoves, in that the radiators are located in the rooms which are to be heated. The greatest defect in this method is the lack of control of the heat to meet varying outside weather conditions. If it is attempted to throttle the steam supply by means of the valves, "water hammer" is likely to take place. This method provides no ventilation whatever, any change of air in the rooms taking place through accidental leakage around the windows or through the walls. The air valves connected with the radiators are apt to be a source of annoyance either from faulty operation or from the odors emitted when steam is turned on.

An attempt to combine ventilation with steam heating is made in the so-called direct indirect system; where each radiator is connected with an airduct leading through the side of the building, the opening being controlled by a damper, a similar one being connected on the side toward the room so that air can be taken from out of doors or be recirculated.

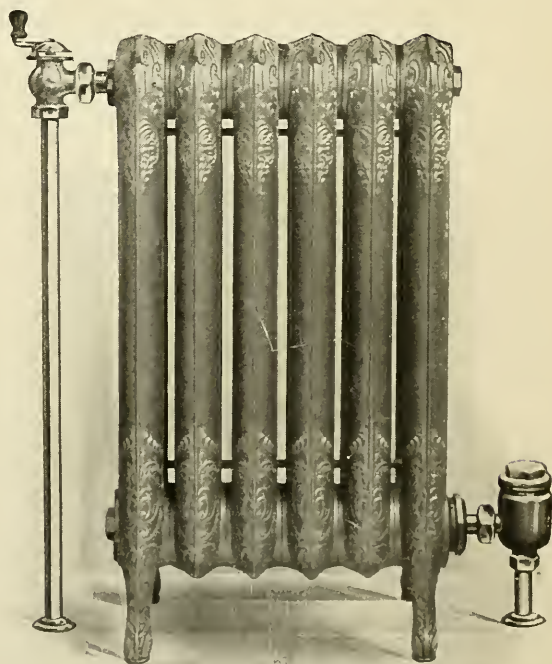
This method gives a fair supply of air under certain conditions; but in the case of strong winds it is difficult to control, as there will be a surplus of air entering from the windward side, while the openings on the lee side of the



INDIRECT RADIATOR HUNG CLOSE TO BASEMENT CEILING AIR DUCT LEADING IN
FROM OUTSIDE PURE AIR



A TYPE OF DIRECT-INDIRECT
SHOWING COLD-AIR DUCT, FROM
SUNNY SIDE OF HOUSE, LEADING
UP UNDERNEATH RADIATOR



STEAM HEATING WITH CONTROL. HAND CON-
TROL VALVE AT TOP COMBINED AUTOMATIC AIR
AND CONDENSATION VALVE AT RETURN END

buildings would tend to draw air out rather than to admit it. The openings guarded by screens in the outer walls are objectionable from the standpoint of the architect, and for sanitary reasons, in that they collect dirt and are inconvenient to clean.

With indirect heating the radiating surface is placed in the cellar near the base of the flues, and corresponds to the method of heating by furnaces. Since the heating surface is placed near the flues, the resistance to air flow is at a minimum, and the supply of air is much more constant and is less affected by winds than when issuing through long lateral furnace pipes.

The indirect method gives an ample supply of fresh air when the outside temperature is fairly low. As this temperature approaches that of the room, however, the velocity of air in the flues is very much diminished with a consequent reduction in the volume of air supply.

In other words, with either the indirect or the direct indirect systems of heating the air supply is not at all uniform. If in mild weather it is attempted to keep up the same air supply as in cold, purely by gravity, the rooms will at once become overheated and unendurable. To overcome the effect of changing outside temperatures on the flue velocities, the fan system is employed, as is pointed out later.

One good method of supplying fresh air to a dwelling having direct radiators is to place a large indirect radiator below the hall, insuring a supply of fresh air to this central distributing point, from which it escapes to the rooms and out through fireplaces and around windows on the lee side of the house.

With the indirect method of heating in school buildings, mixing dampers are employed which combine the hot and cold air in varying proportions without seriously diminishing the volume.

Hot water heating is very popular in many sections and possesses certain advantages over steam heating as commonly installed. When hot water is employed as the heating medium the temperature of the water may be controlled either automatically or by hand to meet varying outside weather conditions. With a climate subject to rapid changes, this is not always a desirable feature, since it takes some time to raise the temperature of the volume of water in the system. On the other hand, however, rooms will not quickly become cooled with a sudden fall in the outside temperature, since the water in the radiators must be given time to cool down to the room temperature; in other words, the large volume of water in the system acts somewhat as the balance wheel of an engine, preventing sudden fluctuations.

Hot water heating is very popular for residence work, as the feature of uniformity of temperature is highly desirable. The heat stored in the water at night will insure a warm house in the morning, whereas with steam heating as commonly installed, in case the pressure falls below that of the atmosphere, the radiators will become cold.

Hot water heating provides a mild temperature, since the water in the radiators is kept at not far from 160 degrees to 180 degrees F. average temperature, whereas with steam the temperature of the radiators is over 212

degrees F. This means larger radiators and piping in the case of the former, which for residence work especially is often objectionable.

In this class of buildings, indirect hot water heating is quite commonly used in the better class of work, affording as it does an ample air supply and ready control of temperature.

For large installations with scattered buildings forced hot water heating is often used, the water being circulated by means of pumps. The essential features of gravity hot water systems are carried out in this system, but on account of the forced circulation very much smaller pipes may be used than when dependence for circulation must be placed on gravity.

The forced circulation systems greatly widen the field of hot water heating, making possible the adoption of this system where otherwise it would be entirely impracticable.

In order to secure the advantages of hot water heating in steam heating systems various vacuum, vapor, and modulation systems have been put on the market. In some of these the control of temperature is secured by carrying the steam pressure in the system at a point below atmospheric pressure with a consequent reduction of temperature varying the degree of vacuum to meet outside weather conditions.

In others, like the "vapor" and "modulation" systems, the valves or devices at the supply and return ends of the radiators are designed to permit a partial filling of the radiator with steam emitting a proportional amount of heat. This is a great advance over ordinary steam heating systems and provides for the comfort and wellbeing of the occupants of rooms, each of whom has control of the temperature by the manipulation of a single valve.

Thus can the mild heat of the hot water system be secured with steam and the overheating of rooms be avoided, with its consequent ill effects.

Where direct radiators are located within three or four feet of seats they should be screened; otherwise, the radiant heat to which persons sitting opposite the radiators will be exposed will be very annoying to them.

Disagreeable odors from air valves may be overcome, and is overcome in the best class of work, by connecting these valves to air lines leading to some convenient point of discharge in the basement.

To overcome the defects of ordinary gravity indirect steam heating systems and to make possible a uniform air supply at all seasons, mechanical systems of heating and ventilation are employed. With such systems, by the aid of fans, air may be discharged at will into any room and by the same means air may be exhausted; thus substituting a practically uniform force for one seriously affected by weather conditions.

Except in large buildings it is common practice to use heated flues for ventilation. While it is more economical to move air by means of fans than by heated flues the simplicity and absence of attention required by the latter favor their use except in large installations.

With ordinary gravity systems the volume of air admitted to and removed from the rooms varies greatly with the weather, the velocity in the flues falling off rapidly with an increase in the outside temperature; whereas, with the fan system, this may be kept practically constant.

In measuring the air flow by means of an anemometer, much depends upon whether the test is made at the inlet or at the outlet, since on the windward side cold air is leaking in around the windows and on the lee side it is leaking out, tending to produce a deficiency in the warm air supply in windward rooms and an oversupply in the others. With loosely fitting windows a considerable portion of the air admitted at the warm air inlet escapes around the windows on the lee side and is of no service whatever to the pupils.

A measurement of the air discharged through a vent outlet near the floor is a better indication of the air passing through the seating space than is a measurement taken at the inlet six or seven feet from the floor.

In school buildings and churches an arrangement should be provided for returning the air for warming the buildings when not occupied. Some one in authority over the janitor should understand the arrangement and see that *fresh* air is supplied during the time the building *is occupied*. Janitors are inclined to throttle down the cold air supply, even with fan systems, so that only a portion of the air intended to be delivered is actually carried to the rooms.

In buildings having rooms occupied periodically, the fan system alone would be a wasteful one to employ. In such cases direct radiation is used in combination with the fan, heating surface being placed directly in the rooms sufficient in amount to maintain the desired temperature.

In the case of hospitals heated by direct radiation with the air supply and ventilating system entirely independent of same, the writer has often found that the fans are allowed to remain idle in order to save fuel and enable the engineer to make a good showing in his reports. It is, therefore, highly important in hospitals and similar institutions of this kind that the operation of the fans be carefully noted by some one connected with the medical staff.

In the case of hospitals where direct radiators are used in the rooms, these should be of perfectly plain pattern, so that they may be easily cleaned. The radiators should preferably be supported from the walls by brackets, leaving the floor clean for sweeping and mopping; otherwise high legs should be used in order that the space below the radiators may be easily kept clean. Wall radiators are also very desirable for this service in that they can be supported entirely clear from the floor. The flues should be accessible, so that they may be easily cleaned.

The arrangement used in certain schools may well be applied in hospitals, viz., having the inlet and outlet openings to flues finished with a mitered frame, but left entirely without screen or register, thus leaving the flues accessible at all times for cleaning.

When heated entirely by the indirect method, one may be pretty certain that fresh air will be furnished, since the occupants will demand heat, but may not notice a lack of ventilation.

That good ventilation costs money in coal consumption is apparent, if we consider that in the case of a room heated by the indirect method with warm air at say 120 degrees, the air escaping at 70 degrees from the room carries away seventy one hundred and twentieths or seven twelfths of the

heat brought in when the outside temperature is at 0 degrees F., therefore under these conditions five twelfths of the heat brought in is chargeable to the heating of the room and seven twelfths to its ventilation. These ratios vary, of course, with the temperature of the entering air. In spite of its cost it is pretty generally admitted that adequate ventilation is to be considered a necessity to school buildings.

In some of our states compulsory ventilation laws require that thirty cubic feet of air per minute per pupil be supplied. This corresponds, as a rule, to an air change every seven or eight minutes, and in some cases to a more frequent one. The air supply to churches, which are occupied for shorter periods, is considerably less per capita, as the building is supposed to be filled with fresh air at the beginning of occupancy, and therefore a smaller supply than in the case of continually occupied rooms will maintain the desired degree of purity for a period of an hour or so. Twenty cubic feet per minute per capita is considered good ventilation in such cases. In halls it is often difficult to provide as great an air supply as this without producing objectionable draughts.

As to the rapidity with which air may be changed in a room, much depends upon the location of the inlets. If placed six or seven feet from the floor a velocity at the inlet of four hundred feet per minute or thereabouts is entirely feasible. If placed near the floor the velocity at the register must be less than half the above-mentioned velocity if seats are located near the inlets.

Ventilating registers should be placed in the side walls near the floor, or better, openings should be placed in these locations, as the screens or register faces perform no useful function and make insanitary the bottoms of the flues back of them. It is far better to do as is customary in the Boston schools, viz., finish the opening neatly and leave it entirely free from any grating, controlling the air flow by means of a damper concealed in the flue.

Floor registers, while not entirely done away with in public places, are an abomination, as they are frequently used in place of spittoons with consequent filth and danger to health.

In public buildings the relation between the supply and removal of air is an important one. It is common practice to make the ventilating fans approximately twenty-five per cent less in capacity than the ones that supply the air, depending on the difference escaping by leakage, on the theory that a slight plenum in the room will prevent draughts.

Whenever the exhaust ventilation greatly exceeds that of the supply, cold air will be drawn in around the doors and windows to the discomfort of those sitting near them.

A great deal of attention has been paid of late to preventing air leakage around windows, and several patented devices are on the market for this purpose. This is important from the standpoint of fuel saving, but it should not be overlooked that fuel saving is not the only desideratum, and that provision should be made for admitting the requisite volume of fresh air to rooms heated by direct radiation without producing draughts.

Comparatively little has been done regarding the ventilation of office

buildings. Window ventilators of greater or less merit are frequently applied and give partial relief from a stuffy atmosphere. (See Chapter II.)

In certain office buildings a very satisfactory arrangement is provided for successfully ventilating the offices, corridors, and toilet rooms in the order named, the latter being connected by flues with exhaust fans on the roof. Louvered openings are provided in the partitions between corridors and toilets and the transoms over the office doors provide for the egress of air from these rooms. The fresh air supply to offices so treated is provided through window ventilators.

Our building laws require certain minimum air spaces to be provided in tenements. In office buildings, however, a number of clerks will often be crowded into a small room where no provision whatever is made for ventilation. These persons are bound to suffer in the long run from their close confinement and the absence of fresh air. The lower floors of office buildings are generally provided with mechanical ventilating systems.

An excellent method of providing fresh air to all offices is that known as the corridor system, in which flat rectangular galvanized iron ducts are furred in above the false ceiling in what is otherwise useless space. These are connected by vertical shafts with supply fans located in the basement or on the roof. The offices may be heated by direct radiators, or the heating may be accomplished entirely by the fan system, preferably the former. The ventilation of the offices takes place through provided openings in the partitions or through transoms into the corridors from which the foul air is exhausted by means of fans.

Greater attention has been paid of late to automatic temperature control in buildings, and many important buildings to-day have the temperature kept uniformly at 70 degrees, without any attention on the part of the occupants. This is a decided gain over old methods, not only from a hygienic standpoint, from but an economic one as well. In the case of schools, for example, the teacher is not disturbed by the necessity of regulating the heating apparatus and is enabled to give undivided attention to the real work in hand.

It is important that bath rooms and toilet rooms be ventilated either through heated flues or by ducts connected with fans. It is better to use exhaust ventilation only from these rooms, depending on drawing air in from the corridors or around the windows, provided sufficient radiating surface is supplied. It is objectionable to put a forced air supply into rooms of this kind, causing some of the disagreeable odors to be carried to other parts of the building.

A considerable advance in heating and ventilation by fan systems has been brought about in the past few years through the use of air washers, which take the place of cheesecloth screens formerly used. These were allowed to become fouled with dust, contaminating the air supply and seriously cutting down the volume admitted to the building. With modern air washers the dust is thoroughly removed, the water being recirculated by a pump. This apparatus also provides for humidifying the air.

The matter of humidity is receiving more and more attention, and there

is no doubt that the comfort and health of the occupants of buildings is materially increased by artificially raising the humidity.

In this connection the author of this chapter will conclude by quoting some extracts from a paper by Henry Mitchell Smith, M.D., of Brooklyn, N. Y., read before the Brooklyn Medical Society:

In order to obtain data from which a starting point for improvement could be made, records of the temperature in a large number of houses have been taken by the writer (Dr. Smith). It was found that it commonly ranged from seventy-two to seventy-six degrees, and at times, in very cold weather, seventy-eight degrees Fahrenheit was recorded.

Startling as are these figures in themselves, and contrary to all accepted ideas of the proper conditions for living rooms, yet a puzzling fact was that the sensations of the occupants were frequently not in accord with the readings of the thermometer. Rooms felt chilly when the recorded temperature indicated that they were far too hot. It was often hard to believe that the temperature was above sixty-eight degrees, when it was actually seventy-two and seventy-four degrees.

It was at once apparent that some unrecognized factor was responsible for this discrepancy between the temperature recorded by the thermometer and one's sensations. Moreover, it was found that the colder the weather the higher was the average temperature maintained indoors, an observation which any one may verify and which will show that rooms may feel warm at seventy degrees to-day and decidedly chilly at seventy-two and seventy-four degrees to-morrow. The reason for this is the insufficient amount of moisture in our rooms in proportion to the temperature (low relative humidity). The colder the weather the lower will be the indoor relative humidity. . . .

The point to be emphasized is that every time we step out of our houses during the winter season we pass from an atmosphere with a relative humidity of about thirty per cent into one with a relative humidity of an average of seventy per cent. Such a sharp and violent contrast must be productive of harm, particularly to the delicate mucous membranes of the upper air passages. Watery vapor, what we term moisture, is as much a part of the air as is oxygen; absolutely dry air does not exist in nature. The higher the temperature, the more of a given vapor is required per unit of space before the vapor becomes saturated. A cubic foot of saturated watery vapor at a temperature of thirty degrees Fahrenheit weighs 1.935 grains; at seventy degrees Fahrenheit it weighs 7.980 grains whether the cubic foot contains air or not. . . .

The skin and the mucous membranes of the respiratory passages are the principal sufferers, since these tissues are always kept moist with their own secretions, and from them water is freely abstracted to satisfy this large saturation deficit, such air passing with every inspiration over the moistening surfaces nature has provided in the mucous membranes calling for an enormous output of the fluid elements of these tissues. This leads to glandular overactivity and its consequent evils. . . .

A moment's consideration shows that the prevailing practice of depending upon the thermometer as the sole guide in the heating of buildings is not only inadequate and unscientific, but it is often misleading. It is not sufficient to know only the temperature if we desire either comfort or health, for the same temperature produces varying sensations of warmth or cold, depending upon the relative humidity at the time existing.

It is unscientific and arbitrary to lay down a fixed temperature as a standard for living or sleeping rooms unless the relative humidity is indicated as well.

At New York and along the Atlantic coast the prevailing winds during cold periods are usually from the north or northwest, having passed over a dry, frozen area, which has presented little opportunity for the air to take up moisture. At such times the temperature of the air indoors is allowed to become as high as seventy-six to seventy-eight degrees in order to feel comfortably warm. Records from steam-heated apartments show that the relative humidity was sometimes as low as twenty-five per cent, with a temperature of seventy-eight degrees, during a period of very cold weather in January, 1902. The high temperature is necessitated by the chilling of the body by the increased evaporation, evaporation being essentially a cooling process.

It is needless to say how unhygienic as well as uncomfortable is such a distortion of the proper relationship between temperature and relative humidity. By regulating the indoor relative humidity we could keep our room temperature much more nearly stationary, irrespective of the temperature outside. But no improvement in indoor atmospheric conditions can be expected until heating engineers and the people realize that with the ever-varying absolute humidity out of doors no system of heating can be made satisfactory if the indoor relative humidity is disregarded. Even thermostatic temperature control will not fill the requirement, for a constant temperature is constant in its effect only if accompanied by a constant relative humidity. . . .

These tests were most instructive. In the first place, it was observed that with a proper percentage of moisture seventy degrees Fahrenheit was uncomfortably hot, sixty-eight degrees Fahrenheit warm, and sixty-five degrees comfortable. By proper percentage of moisture is meant one which is never below fifty per cent or above seventy per cent, average about sixty per cent. It was determined by repeated experiments that a temperature of from sixty-five to sixty-eight degrees, and a relative humidity of sixty per cent produced the most comfortable conditions, which were in marked contrast to a temperature of seventy-two degrees Fahrenheit, with a relative humidity of thirty per cent. The former felt warm and balmy, the latter, notwithstanding the higher temperature, chilly and dry, and the slightest motion of the air suggested a search for the source of the suspected drafts.

Moreover, properly moistened indoor atmosphere lacks all the oppressive dry feeling so characteristic of the average artificially heated room. . . . The quieting effect of such an atmosphere is striking. There is an indescribable sense of relaxation and "poise," contrasting strongly with the feeling of nervous tension so frequently experienced in overheated dry rooms.

It was satisfactorily proven that one may live during the coldest weather with perfect comfort in a room at sixty-five degrees Fahrenheit, where the relative humidity is kept at about sixty per cent. During the experiments upon the sensations produced by different percentages of saturation and in order to obtain the opinion of persons having no knowledge of the existing conditions, one room was equipped with a moistening apparatus, and the temperature kept at sixty-five and sixty-eight degrees, with a relative humidity of about sixty per cent. An adjoining room, without a moistening apparatus, and heated by an ordinary steam radiator, had an average temperature of seventy-two to seventy-four degrees, with a relative humidity of thirty per cent. In every instance and without at all knowing what the temperatures were in the two rooms, the opinion was unhesitatingly expressed that the first room was several degrees warmer than the second.

It has been mentioned that the feeling of comfort was greatest in a room at sixty-five degrees, with a relative humidity of sixty per cent produced by artificial means. It was most interesting and instructive in connection with this matter to find on the perfect days in May and early June, with all the windows opened, admitting freely the outside air, that the thermometer stood at sixty-five to sixty-eight degrees, and the hygrometer registered about sixty per cent relative humidity. A moment's thought recalls

the fact that we often sit out of doors with perfect comfort at a temperature that would cause us to shiver in our rooms in the winter. The relative humidity is the balance wheel that regulates our comfort at different temperatures in still air. So repeatedly was this demonstrated that it may be accepted as a cardinal rule that if a room at sixty-eight degrees is not warm enough for any healthy person, it is because the relative humidity is too low, in which case the procedure is to raise the relative humidity and not raise the temperature. . . .

It is inconceivable that with otherwise perfect means of heating, provision for producing sufficient moisture to maintain a higher relative humidity should have been so disregarded in all but those elaborate systems applicable only to large halls and public buildings, where with forced ventilation the air may be moistened in the main air ducts. But these systems, from the expense of installing and operating, are impracticable in the ordinary home, leaving the great majority of us to live in an atmosphere of desert dryness, and depriving us of an element almost as necessary for health as a proper degree of heat.

That we are wasting fuel is evident at once from the unnecessarily high temperature we maintain. . . .

Moistening apparatus have been in the main unsatisfactory, because their control has not been independent of the control of the heat source. It is amusing to find that in spite of the advantages of a moister atmosphere indoors objections have been raised against the use of devices for this purpose, on the ground that when the weather is very cold moisture condenses upon windowpanes. It is true that this will happen; it is a natural and logical result of proper conditions. We can all remember that before the days of heating by direct radiation it was usual to see frost on the windowpanes in winter, a condition we now never see with the extreme dryness that our present direct heating systems produce. The fact that condensation does not occur is sufficient evidence of the indoor "dryness." The relative dryness of the average indoor atmosphere in winter is so unnatural and so unhygienic that its correction should receive the serious consideration that the subject merits. . . .

NOTES BY THE EDITOR

In addition to the excellent paper by Mr. Snow, attention is called to what is said upon heating and ventilation under "Public Buildings" in Chapter II, and the examples given, viz. — the Union Depot in Washington and the Larkin offices in Buffalo. Mine ventilation is discussed in the section upon mines in Chapter XXII. In the sections upon plumbing and gas installations, in this chapter, gas heating and the supply of hot water is discussed in detail. Other references are made upon certain phases of the question — see the Index.

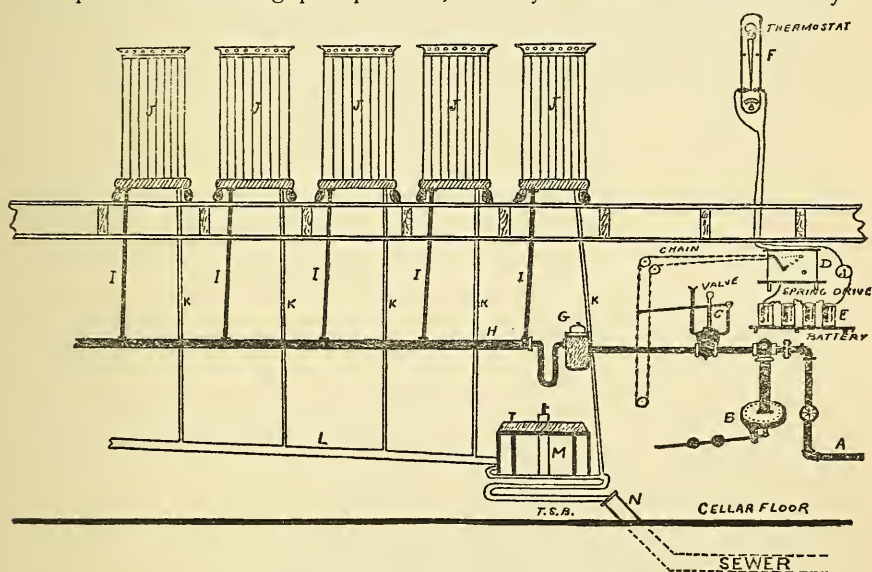
Kitchen ranges demand a few words since there has been very great improvement made in their construction during the last few years and that influence hygiene. One of the most important of these is the rack for burning kitchen garbage with very little if any offensive odor, and that tends to prevent the garbage attracting flies and breeding disease. The steel ranges are most scientifically constructed, but it is well to remember that steel rusts more readily than does iron, and these ranges should not be neglected during the summer. The type of range that has the regulation in the lower portion of the pipe admits of damping the stove at night without the danger of the escape of carbon monoxide gas that is so frequent when the lids are tilted, a means of damping that is also liable to cause fires.

Furnaces should always have side vessels for water so that the warm air may be made properly humid. Most furnaces have such water pots, but they are seldom

filled. It is good practice to build a little fire in the furnace several times during wet spells in the summer. It is good for the furnace, dries out the house and cellar, and prevents the development of summer moulds in the home. Paper and waste can be burned in the furnace for this purpose.

Gasolene and oil cooking stoves are so convenient that it is almost useless to argue against them, despite their danger. But it is necessary to call attention to the fact that these oil vapors are most irritating to persons with throat, bronchial, and lung troubles, and tuberculosis is always aggravated by the vapor from such stoves.

Public heating plants are constructed somewhat like the large central heating plants of large colleges and public institutions, only one factor being very different. Where buildings are grouped, low pressure steam plants are installed with the boiler house depressed so that the condensation returns thereto by gravity. This can seldom be done in a public service plant and high pressure must be used and the condensation must be disposed of by running it into the sewer of each building where it is installed. These plants are becoming quite practical, and they offer a most convenient way to



INSIDE INSTALLATION PUBLIC HEATING PLANT

A — Pipe from street main. B — Valve regulating volume of steam. C, D, E, F — Parts of electric heat-regulating device. G — Meter. H, I — Steam supply to radiators (J). K, L — Pipes carrying condensation to steam trap (M) and thence to sewer (N).

heat a building. I have had considerable experience with such heating, and, while it is not well to take up space discussing the plant and street construction, it will be worth while to discuss the inside installation.

The drawing herewith illustrates the connections commonly used. The electric regulation keeps the house at a constant temperature, the valve (C) being automatically opened and closed. The *volume* of steam is regulated at (B) by moving the balls upon the rod. Some persons prefer the condensation meter which is placed near the trap instead of at (G). A model plan consists in placing the radiators in boxes in the cellar, one at the base of each register pipe used, which provides for ventilation as well as heat-

ing. This outfit requires no routine attention except winding the spring drive at intervals and keeping the battery charged and affords a rather expensive but thoroughly sanitary installation for the home or large building.

Culm and coal screenings are generally considered as waste products. The culm furnace is devised to burn them, and very large claims are made for the efficiency of the device, many of which have been installed in the Eastern cities. Certainly the fuel is cheap, provided one is near to the culm banks, but freights would be as heavy upon culm as upon larger coal. Many of the culm banks are mixed with dirt and earth, and one should assure himself of the supply of fuel before installing this device. Here in Harrisburg, the water works, the steam-heating plant, and several factories use the type of boiler illustrated in the photograph, and the small "river coal" burned costs about \$1.25 per ton. Such small coal cannot be burned in the domestic stove.

No one should attempt to burn coke or bituminous coal in the stoves or furnaces devised for hard coal, and the small chimneys common in hard coal districts do not successfully carry off the gases and smoke of the soft coals. It must not be forgotten that climate and latitude is a very large factor in the question of heating and ventilation, hence specific plans cannot be given here covering every section of this large country.

GAS INSTALLATIONS*

IN Chapter XXII there is a section dealing with public lighting plants. In this present section we will discuss inside installations, but must speak of some of the chemical problems incident to the making of illuminating gas.

Acetylene gas is liberated from calcium carbide by the addition of water. It furnishes a high degree of illumination and proper installations give satisfaction and are recommended where there is no public gas works. Since the gas is not very readily detected by the sense of smell, unless in considerable quantity, and the toxic influence is great, the house piping should be tested for leaks before the product is used. Amateur construction should not be attempted, and the generator *must be placed in a building some distance from the house* and great care be taken to avoid explosion.

Natural gas is very rich in carbon and the products of its combustion are very deleterious to health. This gas should never be used in stoves lacking a connection with the chimney. The pressure varies more than does made gas and the stoves and surroundings must be so arranged that a sudden increase of pressure will not increase the fire hazard. Properly piped and handled, this gas is a good and very convenient fuel.

Gas meters of the ordinary kind offer no hazard, but the so-called "quarter meter," arranged with a slot into which a twenty-five cent piece is dropped to turn on the gas, is a source of danger. In a private house they may be safely used, but in a rooming house or one housing several tenants some one is apt to leave his gas burning and the supply run out during his absence or when sleeping; then, some other person may turn on the gas with a coin, and it will escape into the room at the open jet or fixture.

Piping must always be well erected. Nearly all such construction is put in by plumbers, and for some inscrutable reason many of them argue that it need not be so tight a job as must piping for water, since the pressure is less in the case of gas. Many families suffer ill health from numerous insignificant gas leaks. When a house is erected, the gas pipes should always be well tested before they are plastered in, and again after the carpenters finish. Many gas companies will do this testing free. Never accept a job unless the plumber makes clean threads and leads every joint and then screws them well together. Municipal law should require an inspection of every private gas installation. Rubber hose connections are bad. Gas stoves should always be permanently connected up. Table lamps may have a drop connection, provided the tubing does not come from an inverted T joint. A goose neck fitting over the fixture tip is much the safer.

Gas fixtures, as made by reliable houses, are seldom a source of danger, but they must be well erected. Combination gas and electric fixtures are not to be commended. The trouble is that the electric light workmen detach the gas connections and leaks are frequent. The cocks of any gas fixture

*By Allen S. Graham, A.B.

should be watched to see that they remain tight. Heating water by gas is discussed in this chapter in the section upon plumbing. The kitchen gas range may be an element of danger, but is seldom so with any degree of intelligent management. Gas stoves of any kind not connecting with the chimney have their limitations gauged very largely by their size and the degree of ventilation of the apartment in which they are used. Gas heaters in bathrooms should have chimney connection.

Gas lights of the open type vitiate the air to some slight extent, but not nearly so much as do oil lamps. The water gas does not have a high illuminating power, although it is rich in hydrogen and has very great heating power. This will be discussed later. Suffice it to say here that the ordinary gas tip must be supplied with a gas rather rich in CO and hydrocarbon vapors to be sufficiently luminant and the products of combustion contain carbon compounds. However, combustion is fairly perfect, and the vitiation of the air is not great. The various kinds of mantle lights afford better combustion, but liberate more heat. Aside from the annoyance of the heat in hot weather, the mantle lights are more hygienic. They can be operated with a gas containing very little CO, and are so operated in Europe, where the old coal gas process is largely in use. Over there they do not have the plentiful supply of oil that we have here. The self-lighting mantles are operated by the unconsumed gas coming into contact with spongy platinum and a small amount of gas escapes into the room before the platinum is sufficiently heated to ignite the gas. The older the mantle the more gas escapes before it ignites, and this type of lighter is not to be wholly commended.

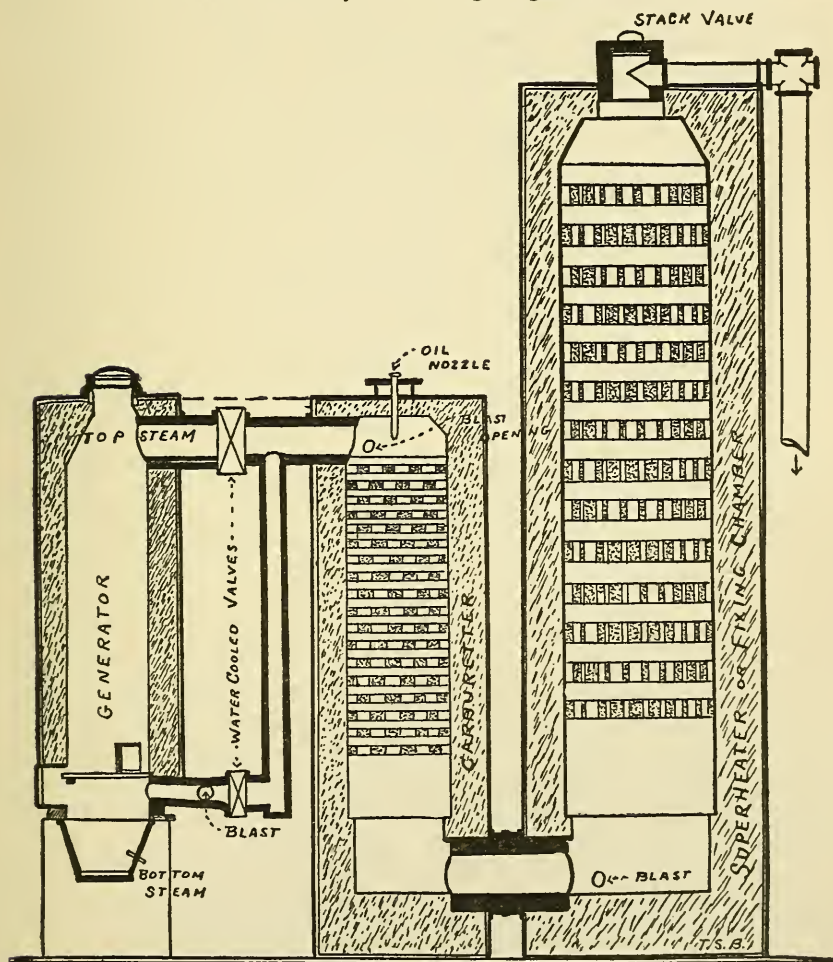
Gas leaks.—The leaking of gas into an apartment is always prejudicial to health, and there is no structural excuse for such leaks except the inherent tendency of everything to breaks and wear. It is always safer to consider any leak dangerous and to attend to it at once. Admixtures of gas and air will explode under certain conditions. The most violent explosion results from the ignition of a mixture of one part of gas and eight parts of air, but it is necessary for there to be one part of gas to eleven and one half parts of air before an explosion can occur at all, while if the gas is found in the proportion of one part of gas to four parts of air, an explosion will not occur, as there is not a sufficient amount of oxygen to support an explosive combustion.

COMPOSITION OF GASES

	Coal Gas	Water Gas	Carburetted Water Gas
Carbonic Acid.....	1.60	6.30	2.70
Oxygen	.39	.50	.70
Heavy Hydrocarbon.....	4.25		12.80
Carbo Monoxide	8.04	33.60	30.70
Hydrogen	47.04	50.20	32.40
Methane	26.02	2.70	13.90
Higher Paraffins			2.40
Benzene Vapor	.50		.60
Nitrogen	2.16	6.70	3.80
	100 00	100.00	100.00

The composition of oil gas varies with the oil used and the temperature at which it is gasified. Roughly, it contains twelve to seventeen per cent of H, thirty-five to forty-five per cent unsaturated hydrocarbons, about forty-five per cent methane and ethane, traces of CO_2 and O, one to three and one half per cent N, and a trace of CO.

These gases are all of value depending upon the uses to which they are put. Coal gas does not make a sufficiently brilliant light to compete with electric light except when used in mantle lights, to which it is excellently adapted. Despite what most textbooks say, unmixed water gas is not much in use for lighting, but is valued on account of its large amount of H, and the cheapness of the product. To make this gas serve American purposes of illumination, it is carburetted by combining oil gas with it, and is then called



DOUBLE SUPERHEATER CARBURETTER
(Lowe) Water Gas Apparatus

carburetted water gas. The following sketch is copied from the 1906 "Proceedings of the American Gas Institute," the annual volumes of which contain a wealth of information upon the many complexities of gas making.

In this apparatus water gas is made in the "generator" by decomposing steam in contact with carbon at a high temperature. The carbon is supplied by a fire of coal or coke. This water gas passes into the "carburetter," in which oil gas is made by the destructive distillation of liquid hydrocarbons. The two gases then enter the "superheater," in which they are blended and the oil gas fixed. The proportions of the two gases must be carefully controlled, so as to secure the maximum of illuminating value. In practice this apparatus is first heated up with the stack valve opened for the escape of undesirable products, and then it is closed and gas-making proceeds until the temperature falls to too low a point. Then the stack valve is opened and a blast turned on to reheat the apparatus. There is a succession of "blows" and "runs" and the unpurified gas is collected through a wash-box which prevents its return to the generator and removes some of the ammonia. However, it is only after gas cools that the tar is fully disposed of. The next process is called "scrubbing" and that removes more tar. The rest of the handling is largely mechanical, except passing the gas through the purifier of hydrated ferric oxide, which removes the H_2S . The resultant is iron sulphide and water, the gas being composed as indicated in the third column of the table. The vapors from the purifying box have quite a curative action in whooping cough. It may be added that, aside from the chemicals noted, this box emits traces of carbon bisulphide and hydrocarbon vapors. So many controls and tests are in use in a gas works that deleterious impurities do not reach the consumer in any appreciable amount. Sometimes gas "drips" may get into a sewer and create a bad odor largely due to the benzol in its composition. When that occurs the company should be notified.

The most toxic agent in gas as it reaches the consumer is CO or carbon monoxide. Fortunately, its combustion is quite complete, due to the hydrogen in the gas and the oxygen in the air; the reaction being $2CO + O_2 = 2CO_2$, or one cubic foot CO will combine with 0.5 cubic feet of O and form one cubic foot CO_2 . Naturally, some vapor of water is formed during the reaction. Estimating from this, an ordinary six-foot gas burner will produce two feet of carbon dioxide in one hour of burning and a mere trace of carbon monoxide. With any sort of ventilation this is not a dangerous amount of contamination for a small apartment. But it must be estimated that, so far as carbonic acid gas or carbon dioxide is concerned, one gas burner liberates as much as does three human beings. In this estimate it must not be forgotten that the human being liberates into the air other poisonous substances besides carbon dioxide.

No gas company will contend that the products of the combustion of gas should be counted as a negligible factor, but private consumers are very liable to order in gas stoves and water heaters consuming a large volume of gas and have them placed in very small rooms such as bathrooms. Some gas companies are refusing to connect up such heaters in bathrooms unless the products of combustion are vented to the outside air. Invalids, and especially

persons with throat and lung affections, should not depend upon a gas stove, except as an auxiliary heat, unless connected with the chimney. Some of the older types of gas-heating apparatus are very insanitary and are condemned by the large gas corporations.

Like everything else, gas has its limitations and its advantages and should be reasonably used. Good gas properly piped to well-made apparatus is very convenient and safe and does not impose a hazard to health. There has been much published that is very unfair to the gas companies. It is not true that the older ways of making gas were less hazardous and gave a better product from the sanitary point of view. Medical textbook writers are inclined to accept old data at its face value and few of the latest writers appear to have studied the gas question practically. As a matter of fact, the modern gas-making plant is a great advance upon the old type, imposes less danger upon its workmen, lays better construction in the streets and supplies a gas of greater candlepower. Inside construction has not kept pace with the gas companies, and it is time that city ordinances require a better original installation and greater inspection of the gas pipes and appliances inside of buildings. The mantle lights are a great improvement upon the old "fish-tail" burner and afford an illumination that is effective and does not strain the eyes, provided proper shades are used. For heating gas cannot compete with coal as to price, but offers great convenience and when treated as reasonably as one treats a coal range it is healthy and not overly dangerous. Certainly one would not expect to heat a room with a coal stove not connected with the chimney and would not expect it to give good service unless properly cleaned and cared for. Every user of a gas stove should learn how to intelligently handle it and avoid explosions in the oven by using a little common sense.

"*First Aid for Persons Overcome by Gas*" is the title of a little book widely circulated among gas employees. In it the advice is given to send at once for a physician, but practical directions are given for immediate aid. From this book the following is quoted:

Class 1.—Symptoms: Those slightly affected, complaining of headache, dizziness, nausea, or vomiting, and great drowsiness; with relaxation of muscles, hurried breathing, and rapid heart action.

Treatment: Take patient immediately into fresh air, loosen collar and open shirt, at the same time walking him around. Give Weiss beer (or any effervescent water) while walking, followed in five minutes by a half teaspoonful of aromatic spirits of ammonia in a third of a glass of water. This dose may be repeated every fifteen minutes for not more than four doses. Walk him around until he recovers; then watch him, as he may have a sinking spell, in which event the same treatment must be renewed. . . .

Class 2. Symptoms: Those seriously affected but still breathing. The patient is apparently "knocked out"; he is either half conscious or unconscious,—very weak, and his breathing is rapid and weak.

Treatment: *Send for a doctor at once.* Carry patient immediately into fresh air. In this class of cases he is too weak to walk and is unable to swallow. Then follows

detailed and illustrated directions for artificial respiration and rubbing, clearing froth from the mouth, dragging forward the tongue, etc. Medication and hot applications are to follow.

Class 3. Symptoms: Those apparently dead, not breathing at all. Artificial respiration of the most positive type for at least an hour is recommended.

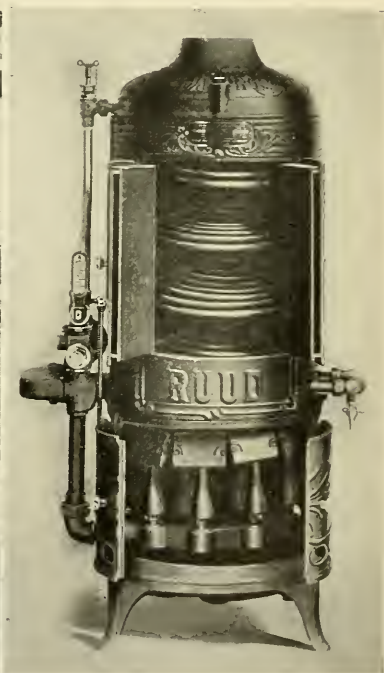
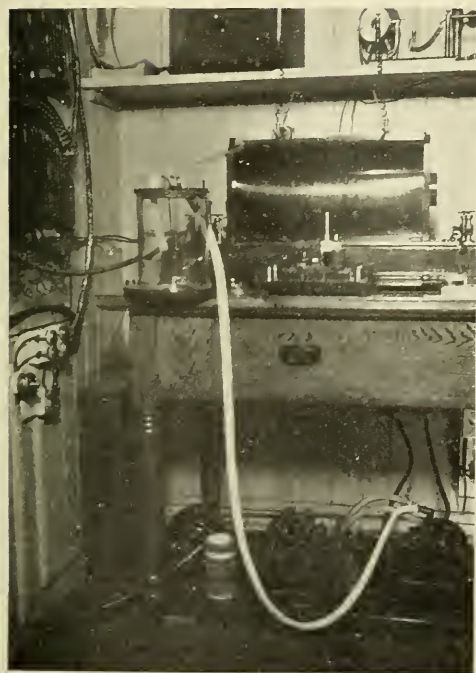
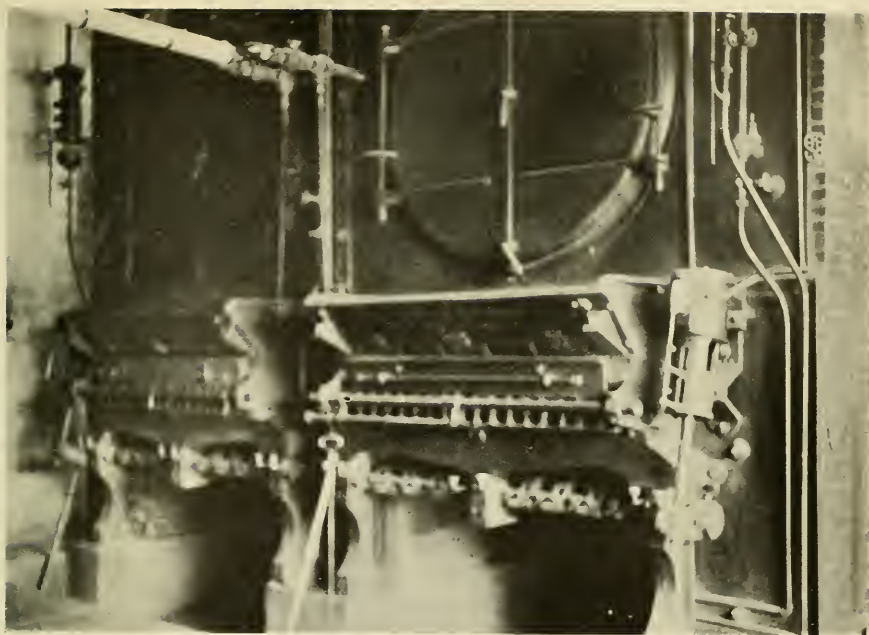
A physician may administer oxygen gas, amyl nitrite, nitroglycerine, or stimulants, as may be indicated. The Weiss beer recommended acts by bringing up from the stomach any gas swallowed.

ELECTRIC LIGHT AND OTHER ELECTRICAL INSTALLATION*

IN former years, when conversant with the actual work of installation, I never liked to erect a private electric light plant; since they are seldom properly cared for and the inexperienced persons in charge are so liable to cut in carelessly constructed circuits and run other risks of fire. In a home one seldom sees private generators to-day, and we can ignore them in this paper. There are many small towns in which the electric light company carries no day load and the line is dead for several hours every day. In this event physicians and others who need current in the daytime are compelled to erect storage batteries unless the company does so itself. It must not be forgotten that storage cells produce irritating gases, and they should be kept in an apartment that is well ventilated and so placed as to preclude the possibility of the vapors reaching the living apartments.

The service wires should enter the house on the slack, that is, the wire should be so fastened to the insulator as to allow a slack between the insulator and the porcelain tube penetrating the wall; so that rain water will not run down the wire and wet the interior of the wall, but drip off at the sagged or slack portion of wire. The so-called Underwriter's Rules govern all electrical construction erected in buildings insured against loss by fire. If these rules are really carried out, there is no safer light installation, so far as danger from fire is concerned; but if they are evaded or neglected, the danger may be and usually is imminent. These rules are too complex to warrant reproducing them here.

Inside wiring should be enclosed. The ordinary rubber-covered wire attracts dust and flies. The negative side especially has an electrical attraction for dust and the wires become covered in a short time. In erecting a house the wires should be run in the walls, but when the wiring is done after construction, the moulding commonly in use is safe and sanitary, and collects very little dust. Wires going through floors should always be run in porcelain or metal tubing, since water used for scrubbing is apt to produce a short



A SELF-STOKING, SMOKE-CONSUMING TYPE OF BOILER
 EXPOSED WIRING, X-RAY MACHINE A GAS-CONSUMING WATER HEATER

circuit if it can reach the wires. There should be very little use of flexible cord, as it soon becomes filthy. Switches, fuses, cutouts, and all other fixtures should be sufficiently protected and of a size commensurate with the maximum load. All motors, electric irons, and heaters, and physician's therapeutic cabinets should have a separate switch to cut them out of circuit when not in use, since rheostats and starting boxes are liable to heat to a dangerous degree as well as waste the current and be a source of danger from shock from a supposedly dead wire. So far as is possible, knife switches, bus-bars, fuse blocks, and exposed metal should be enclosed. Especially should this be done in hospitals and wherever there are large installations.

All cellar work and that over cement or stone floors, such as in operating rooms, should be of the very safest type. It is best to have snap switches for all circuits in such locations, since many lives are lost through grounding through the floor and exposed metal about a lamp. The ordinary lamp socket is not deep enough for the metal collar on the lamp bulb to screw fully into it and an exposed portion is often left. Where such faults already exist, it is well to wind insulating tape about the collar of lamps and to renew the tape whenever a fresh bulb is inserted.

X-ray machines use a large amount of current and when in action cause a fall in voltage through the rest of the building. Consequently, they should have a separate circuit and separate fuses. The enclosed fuses are best, as they must be heavy, and when such a fuse "blows" it may start fire unless enclosed.

When arc lamps are used in a building, the enclosed type is safest, but the use of arc lamps in interiors is going out as the Nernst and the metal filament incandescent lamps are largely taking their place. The Nernst lamp does not work well upon the direct current circuit and is not very largely in use in residences. Arc lamps require a high voltage and are too dangerous for residence use. The "incandescent arc" runs upon the ordinary incandescent circuit, and is comparatively safe, but makes considerable heat. When one has the alternating current, the Nernst lamp is excellent for residences, but is rather expensive, since it is connected to the side wires and uses double the voltage of the incandescent lamp.

Lamps are run upon different systems of wiring. The most common system in the built up section of a city is the three-wire system. Two one hundred and ten volt dynamos are connected in series, with a middle wire between them, and this middle or neutral wire is grounded. All three wires are run into a building unless it is intended to use very little current. The incandescent lamp uses one side and the neutral, and consumes its current at from one hundred and ten to one hundred and twenty volts. The circuit is balanced by connecting one half on one side wire and the other half on the other side wire. Motors and Nernst lamps are connected to both side wires and get double voltage. Small motors may use only one hundred and ten volts. Never forget that the neutral wire is grounded, as this may save trouble. It provides safety from lightning and crossed wires as the heavy voltage is apt to jump to the neutral and escape to the earth. On the other

hand, it presents a danger due to the fact that one side wire and a water, steam, or gas pipe may complete a circuit. For this reason, never run any incandescent service or interior wire too near to any kind of piping. Be very careful about lamps placed over sinks or bath tubs, and be sure the fixtures are protected. Porcelain sockets are the safest. Never grasp any kind of metal fixture when turning on a lamp. Physicians need to be especially careful that they do not turn on the gas while holding an electrode connected to an electrical cabinet actuated by the street current. The same warning applies to touching the radiator or the water faucet. One may not get any current, and, again, one may be seriously hurt. It is best to have no kind of pipes within reach of a cabinet. For the same reason it is bad practice to run electric wires over or through gas fixtures.

The alternating current is more dangerous than is the direct current. If one lives in the suburbs the cost of heavy lines necessary for carrying the direct current will make it probable that the alternating current will be the only one available. With proper stepdown transformers the current for house consumption is reduced to a safe voltage, but one cannot insist too much that the transformer is a good and safe type and well protected from the weather. The best commercial practice is to deliver the high voltage alternating current to substations, and cut down the voltage by means of a rotary transformer, which may deliver either the direct or alternating current, according to its construction. This method is safer than is that depending upon the transformer boxes placed upon the poles. In case your pole transformer takes fire, let your circuit alone, except to carefully open the main switch and cut out your house.

Never drive nails into moulding containing wires. Never hang anything upon electric wires. Never stick pins or tacks into flexible cords. Never loop the cord or the wires over pipes, other wires, nails, or hooks. Never try to fix a broken circuit with the current on that circuit. Never allow electrical apparatus to become dirty or covered with oil or water. If you go away for some time throw off the main switch. Never use the commercial circuit for therapeutic work unless you have good and well-guarded apparatus.

The electric light consumes no air nor does it vitiate the air. Hence, it is a sanitary light. The illumination is more steady and less apt to flicker than is the light emitted by the ordinary gas burner. Poor service is common, and then the light is wretched. If one lives in a place where the electric light company wants to make an incandescent lamp bulb last long by supplying to it a voltage below its rating and so save themselves expense, do not fuss with poor light, but demand a rate for current only and supply your own lamps, buying those of a volt rating lower than the company claim to be delivering.

Telephones are connected upon various kinds of circuits. An all wire circuit with central battery system and motor-driven magneto ringer is common at the best exchanges. Such circuits should always have an arrester for protection in case of storm. Telephone wires do not collect as much

dust as do electric light wires. It is always well to cleanse the mouthpiece of the transmitter at frequent intervals. If a member of the household has tuberculosis, this is especially important. Never keep a pencil at your telephone for public use, for all kinds of people are apt to place it in the mouth, and then you may do the same thing yourself and contract an infectious disease. One needs to be quite careful when using public telephones. Do not leave the transmitter off the hook in case of storm, as it offers no protection.

SANITARY PLUMBING

WITH apologies to several eminent gentlemen, the writer craves indulgence in his view that this subject has been treated in too academic a manner by most writers. It may seem egotistic for a mere medical man to write upon plumbing, but this one happens to be an amateur mechanic, and has investigated the plumbing proposition from many points of view. However, I wish to declare myself under obligation to the excellent technical writings of Mr. James J. Lawler,* to some friends who are plumbers, to the commercial descriptions of certain firms and to some expensive experiences.

Pipes are of many kinds, but only two are much in use, galvanized iron and lead pipes. Lined piping has been tried, but does not work out well in practice. The galvanizing itself is apt to scale off and leave rough places inside of the pipe, also electrolysis is a factor in cities and tends to damage piping. Some soils injure galvanized piping, and I know that some gravel soils here in Harrisburg cut out pipe very rapidly. Copper street service pipes have been suggested. They are very expensive, but probably pay when it is necessary to dig up asphalt paving to make repairs. Copper makes a sanitary job, but is too expensive for general work. It has an advantage in not freezing or bursting as readily as does the iron pipe, at least it is so asserted. Soft water cuts zinc and so galvanized piping should not be used about cisterns or even in wells, since sufficient zinc may be taken into solution to endanger health. Lead pipe costs much more than does iron and is harder to work. However, I have handled a good deal of it, and believe, if few joints are required, it does not take so very much more time to lay it or connect up. One of the expensive features is the making of wiped joints, for which no cheap substitute has been found. After new installations with lead pipes the water should not be used until the surface of the lead has dulled, after which there is very much less liability of poisoning than there is from galvanized piping. Lead pipes do not break readily from frost. Lead makes excellent street service pipe and is required by law in some

*Lawler's "American Sanitary Plumbing" revised edition. New York, Excelsior Publishing House.

cities and is preferred in first-class work by many plumbers. On behalf of galvanized iron it must be said that there are different grades of it and that the process of manufacture has been improved. The rough points in the pipe are apt to be at the joints. It has been claimed that the rough ends left by cutting iron pipe reduce the flow as much as thirty-five per cent in some cases. In the best steam or hot water plants the pipes are reamed and it is good practice to do this with water pipes. The best pipe is reamed and threaded by machinery and only requires hand work on short lengths.

Pumping water is a simple thing to the householder in the city, but in the country the matter is different altogether, and is touched upon in the chapter upon Rural Hygiene (q. v.). In any pump the cylinder, plunger, check valve, and suction mechanism are the important matters, and when hot water is to be pumped no leather or rubber should be used, but hard bronze instead. In connecting systems of piping to a pump avoid sharp turns or angles.

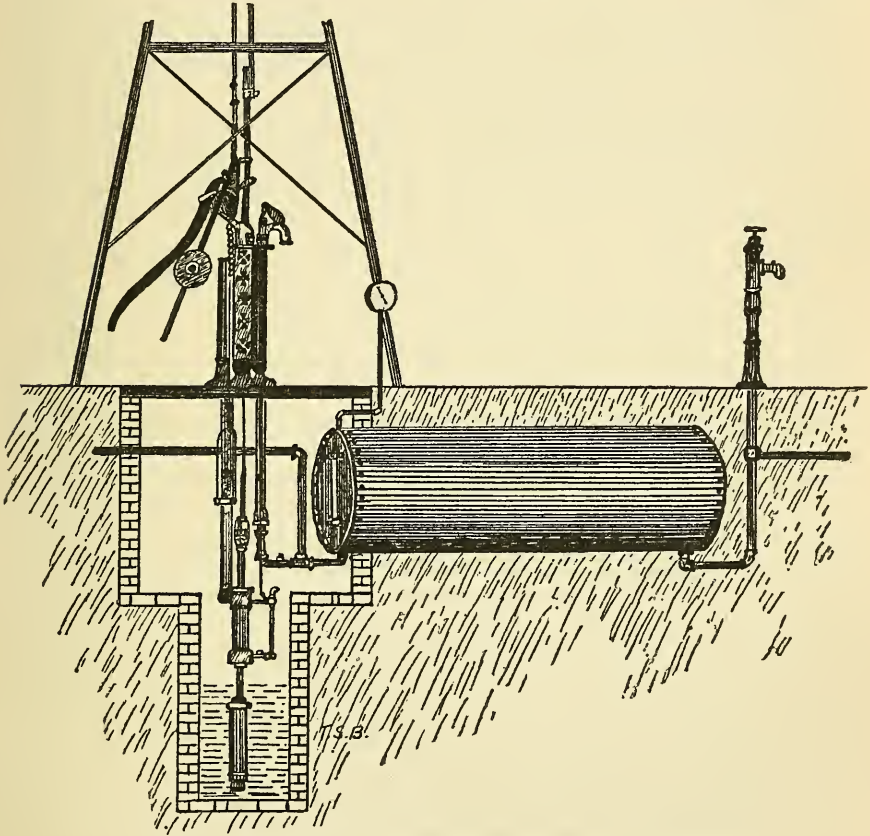
A lift pump has the working parts submerged and is quite expensive. The suction pump works very well when we wish to elevate the water twenty to twenty-five feet, although in theory it should work for a greater distance. Deep well pumps may be set in several ways not necessary to describe here. Lift and force pumps have an air chamber producing compression of the air and a consequent steady pressure upon the extruded water. All plunger force pumps should have an air chamber, and the hydraulic ram works on the same principle. This rather remarkable mechanism will pump water to a height of two hundred feet on a fall of twelve or fifteen feet if the supply is great enough to supply the service and run the ram too. The ratio of efficiency is about as follows — with a fall of five feet one seventh of output of supply pipe can be lifted twenty-five feet; or, with ten feet fall, one fourteenth output may be raised one hundred feet. The principle is excellent and the action is automatic, but it is wasteful of water, and a windmill may be called into service where the supply of water is limited. Usually the windmill is used to pump water to an elevated tank too often exposed to the sun. The several types of rotary pumps are effective for an elevation of but five to ten feet.

The plumber has adapted the hydraulic ram or force pump *idea* to varying conditions where the supply of water is limited. A large steel air tank of from one hundred to twenty thousand gallons capacity is the basis of the plan. This tank is built of boiler steel with heavy dished heads and double stagger riveted so as to be absolutely airtight under a heavy pressure, although in actual practice a working pressure of sixty pounds is rarely exceeded. The tank may be in a building or may be buried in the earth below the frost line, but preferably close to the source of water supply and also close to the pump. The tank usually projects through side wall of well, and so is available for connection, and the water is kept sweet and cool.

The accompanying pen drawing is from the catalogue of the Andrews Heating Company,* but I have modified it slightly. As will be noted, the

*Andrews Heating Company, 1909 Catalogue, Minneapolis, Minn.

base of a windmill is shown connected up with a special form of pump. The mill must be a powerful one with a regulator to maintain a stated pressure in the air tank, and be cut off when the pressure is up to maximum. The tank is buried below the frost line. This outfit will deliver water to a second story very well, except in time when there is no wind, when the pump can be operated by hand. Any physician who has an air tank in his office knows that it takes considerable power to pump it up; so with this outfit, and it must not be expected to deliver enough water for a hotel. However, the



WINDMILL OPERATING AIR-PRESSURE WATER INSTALLATION

makers construct all sizes of pumps for power other than a windmill, as well as tanks of all capacities. For a large installation, a bulldozer horizontal power suction pump with air compressor may be operated by a small gasoline engine or electric motor. On the farm, the small gasoline engine is becoming popular and may be used for many purposes beside pumping water.

Cisterns may supply an excellent water in rural districts provided they are properly arranged. This is dwelt upon in the chapter on Rural Hygiene and a farm filter there figured is the fundamental basis of construction fol-

lowed in the erection of modern rain water supply. These cisterns are divided by a wall into two parts, the first one to receive the raw water and discharge it through the filter bed, occupying the lower third of its capacity, into the other division which stores the filtered water and supplies the pump. It is important that good hard brick and the best of cement be used. Cisterns should be screened from mosquitoes, and the spouting running from the roof to the cistern must have a cut-off to divert the first portion of the shower so that dirt is not carried from the roof.

Water tanks are used for many purposes, those for fire protection and to operate elevators not interesting us here, we will limit our discussion to those supplying water for domestic uses. When the service-main pressure is great, it places a strain upon the whole plumbing system of the house and a well-placed tank will not only equalize the pressure, but will render less heavy construction effective or prolong the life of any installation. Tanks are connected direct to the service main and are regulated by a ball or float-cock placed in the tank in much the same manner as in the flush tank of the bathroom.

Tanks are commonly constructed of wood and lined with sheet metal. Tinned copper probably makes the most sanitary lining, but is very expensive. Lead lining does well with some waters. Double or lock seams should be used and a good job of soldering should be done, since it is hard to resolder a seam when it stands in a vertical position. When a supply is filtered by the alum or other process, it is well to secure the opinion of the water department as to the lining of a tank. Makers of metal tanks are inclined to minimize the dangers of water contamination from their tanks and to magnify the dangers from lead or copper linings. Pure cold water has little effect upon lead and a good lead lining may last for fifty years and contaminate the water much less than will a galvanized tank. When a cast iron house tank is used, the sectional tanks are the most convenient and can be readily set up, whereas a made tank may not be small enough to get up stairs or through doors or windows. All tanks should have a good overflow pipe so discharging as to avoid any possibility of sewer gas working up into the tank. It must be remembered that the overflow pipe seldom discharges any water and, even if it is trapped to a sewer, the trap may break its seal by evaporation of its contained water. It is best to run the overflow pipe to a lower roof or porch roof or to the ground.

Remember to always keep a tank covered or screened to keep out dirt and mosquitoes, and when returning from an absence of a few days, the tank should be emptied and fresh water allowed to enter before any is used.

Service connection is of considerable importance, as bad work may give rise to all kinds of trouble, especially under street paving. All connections to the main should be well blocked up and two feet of lead pipe connected to the service cock to take up all sag or give. If galvanized iron piping is used for the rest of the distance to the house, connect the lead to the iron with a brass nipple and a wiped joint. The zinc in the galvanizing spoils the solder used in making a wiped joint, and a good job is impossible without the nipple. Outside stopcocks are apt to freeze up and this important

accessory to a good job had best be placed in the cellar or near the meter. In cold cellars the piping must be protected, but the cock must be accessible to use in case of a leak or break.

Hydrants are less used than formerly, and the old wood hydrant is out of date, as it was hard to repair, froze up readily, and was very liable to spring a slight leak and make a soggy place in the yard or under a floor and tick up a very high meter reading, as a leak works twenty-four hours a day. Use a metal hydrant or a pave wash with a "goose neck." The latter cannot be turned on by children unless they get the key. Where possible, it is best to put in what is known as a "summer hydrant," the piping coming from the building and protected by an inside turn cock for shutting off the flow during the cold months of the year. Outside hydrants should have direct sewer connection well trapped, and even then it is well to pour a cup of coal oil into the sewer opening occasionally, unless the hydrant is in constant use. Mosquitoes readily breed in these openings or dead ends of sewers.

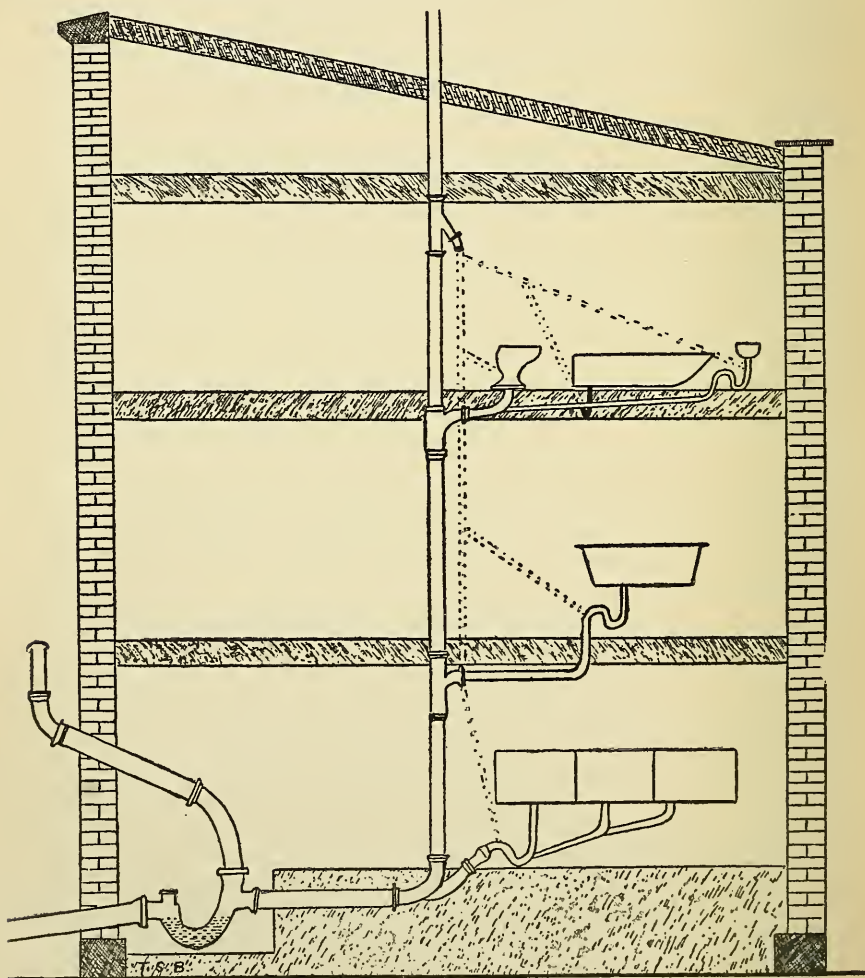
The cellar is where the inside plumbing usually originates. To begin with, most cellars are damp, principally due to water working in from the outside. If down spouts connect to sewers or are carried to good drains, if tight paving such as cement or brick with cement grouting is laid around the walls, if areaways are drained or paved and drained, and if all plumbing is tight, there is little reason for most cellars being damp. The cellar air is largely the house air, and an immense amount of sickness is caused by bad cellars. Let in all the light and air possible and have the cellar floor paved and the walls dressed smooth and lime watched. A wet cellar develops mould and fungi and immense volumes of poisoned air, and beside ruining the health of the inmates, it ruins the house, plumbing, furnace, and pipes, and even the furniture in the house. A damp cellar is one of the poorest investments one can make. A cellar wall should be built two faced and well pointed up, and if the ground is poorly drained, it is well to place tile drain pipes outside of the wall and properly vent them. Few houses are so built, and so it becomes necessary to place a sewered drain in the floor of the cellar. Probably in view of the fact that it is well to scrub the floors of paved cellars, the automatic cellar drainer is the best form to install. This is placed in a slight pit and operates the valves by means of a ball-float, but a full description of the apparatus is not necessary to our present purpose. In the summer time the furnace is cold and the cellar air becomes damp. It is well to open every possible source of ventilation, to take down the smoke pipe of the furnace, and leave the chimney open and store the pipe where it will not rust.

House drains are commonly very poorly constructed. The yard or outside sewer should be of six inches internal diameter if water closets are to be used. The pitch or fall should never be less than one fourth inch to the foot and preferably one inch.

Terra cotta sewer pipe is all right for outside work, but the ten feet nearest the house should be of glazed ware. A glazed or vitrified ware is better for the whole length of the sewer. Some plumbers assert that the first ten feet should be of iron, as there is apt to be a degree of pressure and that may break a terra cotta pipe and allow sewage to soak into the soil. All

joints should be closed with good cement. The soil should be packed around the pipe before the cement sets. The best practice demands that glazed pipe be used in all city work and the cheaper pipe only where the soil is cultivated.

Cast-iron soil pipe should be used for inside work, the joints being closed with melted lead and caulked. Plumbers usually pack with picked oakum and then work in the lead. This pipe must be well trapped. Up through the house it should be of four inches internal diameter and every connection thereto should have its own trap. All individual systems form more or less sewer gas and the pipe should continue on up through the roof and vent freely into the air. It is well to have a fresh air inlet for the soil pipe, but it must be properly put in to be of any use. If the pipe runs through the roof



PROPER HOUSE DRAINAGE (AFTER LAWLFR)

of a back building and there are higher windows near to it, extend the soil pipe to a height above all windows. If a soil pipe is vented into a chimney, the draft may be so strong as to suck the water seal from the weaker traps and allow the escape of gas into the house. Also when the atmosphere is heavy, the gas may be pressed down through the openings of the chimney. Sometimes the length of soil pipe extending through the garret and the roof is made of sheet iron in order to save money. This is thoroughly bad practice, as sewer gas corrodes sheet iron, and before one knows it, he is venting the sewer gas into the attic of his house. Shylock owners of alleged "good houses" palm off these slovenly jobs of plumbing upon unsuspecting tenants and then wonder why "poor people get sick so often."

Laundry trays should never be located in the kitchen, but should have a place of their own provided with adequate lighting, ventilation, and drainage. Soapstone tubs are the best, but any kind except wood are satisfactory from the sanitary point of view. Some plumbers contend that overflows from laundry trays are insanitary.

Kitchen sinks are of many kinds. The wood sink lined with sheet metal is an abomination from the sanitary point of view and only the modern construction should be used. Cast-iron enameled sinks can be kept clean, but the coating is apt to crack off in time. Never box them up with wood as roaches and filth collect around and under them. Well-supported soapstone sinks are almost ideal, while those made of paper or composition have but little to recommend them. Always remember that the kitchen sink is not a slop sink, and do not expect it to dispose of coffee grounds, tea leaves, parings, melted grease, etc. The sink should always be well trapped with a style provided with a brass trap screw. A grease trap is, in the long run, a good investment, and tends to prevent the nasty smell from decomposing grease. As a matter of fact, the kitchen sink is capable of fouling the air of a house quite as much as will a bathroom. All kitchen sinks should be well flushed out with boiling hot water at frequent intervals. Grease traps are of two kinds, those built outdoors and the fixtures for indoor construction. The latter is very convenient, but a little expensive to install.

Hot water supply involves a great many points of interest to the plumber, but not affecting sanitation, such as sagged pipes, poorly connected work, defective circulation, etc. All water boilers should have provision for the removal of sediment. Plumbers can connect up two or more water backs to one boiler and we can utilize the furnace as well as the kitchen range in keeping up the supply of hot water.

The small gas heaters attached to tanks do very well when the tank and gas heater are placed in the kitchen, but when they are in a small bathroom, the products of combustion vitiate the air to so large a degree that they are far from sanitary. By far the better plan is to have a gas reheating system installed in the cellar. There are several makes of these cellar heaters, but practical gas engineers tell me that the Ruud automatic water heater possesses the best patented internal thermostat and automatic water valve. Installed as a reheating system, this device does not heat the water in the boiler, but upon opening any hot water faucet in the house the gas is turned

on and lighted by a pilot, and the coil of copper pipe in the apparatus is so heated as to rapidly raise the temperature of the water flowing through it. The heat continues so long as the water flows, and turning off the water turns off the gas, all but the small pilot light. This device can be had in all sizes, and is connected to the chimney, and there are no products of combustion to poison the air of the house. It supplies unlimited quantities of hot water winter or summer and without the necessity of running the kitchen range, except when wanted for purposes other than supplying hot water. The size necessary for a residence can be connected up complete for about one hundred and twenty-five dollars.

Bath tubs have gradually developed from very crude affairs to the modern porcelain dish expanded to a size suitable for bathing. There are many makes so perfect that it were a mere waste of space to enter into details. The open construction and excellent connections now to be had of any good plumber makes it a safe proposition to leave the details to him. Many old style bath tubs were highly insanitary and should be displaced where still in use. If that is not practicable, have the plumber put them into as good shape as is possible.

Water closets.—What was said about bath tubs applies even more forcibly to water closets. The many makes of all-porcelain siphoning closets equipped with flush tank are highly developed, and are as sanitary as the present state of the plumber's art can make them. It stands to reason that they should be properly connected, so as to vent well and have ventilated traps upon a soil pipe extending above the roof. The old plunger, pan, hopper, and wash-out closets cannot be made sanitary, but when placed in an isolated part of the house, can be made to serve if well cared for, but the better plan is to remove them and install modern construction. Flush tanks should not be left uncovered. When in constant use, it makes no difference, but if they are not flushed off mosquitoes may breed in the water. If one closes the house for the summer, it is necessary to look over the plumbing before going away. Strings in water closets empty the traps by capillary attraction, and evaporation will do the same thing. It is well to pour a small amount of some non-volatile oil into the closet, and that will prevent evaporation. Before flushing when returning, skim off the oil, so as not to run it into the sewer. The oil may do no harm in the sewer, but all forms of grease may clog a pipe badly. Oil may be poured into other traps if they are so placed as to be liable to evaporation.

Septic sewage disposal systems are touched upon in the chapter upon Rural Hygiene, and a pen drawing there shows the plan of construction. The scientific basis is as follows: All organic matter is injurious as soon as it begins to decay, and is saturated with harmful bacteria. If we can change organic matter before decay into *inorganic*, we avoid all this danger. We know that there are *aërobic* bacteria, which thrive in air or oxygen, and *anaërobic* bacteria which do not require air or oxygen. In practice we empty the sewage into a closed tank, and it is there acted upon by the *anaërobes* which largely convert the sewage into inorganic matter. In due time it runs from this tank to the filter bed where the *anaërobes* die and the *aërobes* complete

the work of disintegration. This system must be installed only after careful calculation regarding the many factors involved. Some of the large plumbing houses install private systems in a thoroughly sanitary manner. Municipal systems are practically the same thing upon a larger scale and, as the country settles up and cities pollute streams more and more, it will be necessary to legally require all municipalities to install such a system. In Pennsylvania the department of health has the power to order the offending cities to cease stream pollution whenever they make additions to existing sewer systems. My own city has been ordered to expend several hundred thousand dollars upon such a sewage disposal plant, even though our splendid sewer system is adequate to our own sanitation, except when the river is very low. But we have no right to contaminate the river and spoil it for people living down stream. As discussed in Chapter VIII, water sheds must be kept clean, and it is only a question of time until all cities and all individuals emptying sewage into streams must absolutely cease the practice. Public sewers are further discussed elsewhere in this book. (See the Index. Also see Specifications for Public Buildings, in Chapter II.)

REGULATIONS IN REGARD TO PLUMBING

ISSUED BY STATE BOARD OF HEALTH UNDER AUTHORITY GIVEN IN
SECTION 4673, VERMONT STATUTES

REGULATIONS

I. The plumbing and drainage of all buildings, public and private, additions and alterations thereto, shall be executed under the direction of the health officer, in accordance with plans and specifications previously approved, in writing, by the local state board of health; and suitable drawings and descriptions of said plumbing and drainage shall, in each case, be submitted and placed on file with the secretary of the local or state board of health aforesaid.

No part of the work shall be covered or concealed in any way until after it shall have been examined by and tested in the presence of the health officer.

Two tests of all work shall be made, viz., a water pressure test of the soil, drain, vent, and waste pipes, including the branches to the fixtures, when the weather will permit. In freezing weather, an air pressure test may be substituted for the water pressure. A second test shall be made after the completion of the work. This test should be the smoke test, or a peppermint test with a blowing machine, so as to force the volatile parts of the peppermint into all branches. The ordinary peppermint test may be applied only to old work, but for this the smoke test is preferable. Notice shall be given the secretary of the local board when the work is sufficiently advanced for these tests. The health officer shall require all plumbing to be tested as aforesaid, and he shall condemn and order the removal of any defective material, or any work not done in accordance with these regulations and the plans approved by him or the local board, as aforesaid.

After a plan has been approved, no alteration of the same shall be allowed, except on the written application of the owner.

II. All material must be of good quality and free from defects; the work must be executed in a thorough and workmanlike manner.

Any plumber required to alter work because he has not performed it in accordance with plans submitted, or because it is not properly constructed, or does not stand the tests aforesaid, when required to repair or alter the same by the health officer, shall do so at his own expense.

III. All drain and soil pipes within the building, and for a distance of not less than five feet outside the foundation walls thereof, shall be of extra heavy cast or wrought iron, with lead-calked or screwed joints, not less than four inches in diameter. Cast iron pipes shall be untarred, but may be painted after the water test; wrought iron pipes shall be asphalted or galvanized. When a drain passes near a well of drinking water, or near trees, the iron pipe, as specified above, must be extended beyond these. These pipes must be laid in a straight line, if possible, on a grade of not less than one fourth nor more than one inch to the foot.

All changes in direction must be made with curved pipes, and all connections with "Y" branch pipes. House sewers may be supplied with running traps of the same size and diameter as the sewers, in the discretion of the health officer. In case such traps are used, they shall be near the foundation wall, and provided with an accessible cleanout. In towns and cities having a separate system of sewerage, the running trap on the house sewer may be safely omitted, and house soil pipes may thus act as vents for the street sewer.

IV. Whenever plumbing fixtures are connected with a sewer or soil pipe, the pipes shall extend out through the roof, open and undiminished in size, to a height of at least three feet above the roof. All soil pipes shall increase to six inches, and all waste pipes to four inches above the roof.

Such vent extension pipes shall be of iron, and no brick, sheet metal, earthenware pipe, or chimney flue shall be used as a sewer ventilator.

There must also be a fresh air inlet pipe in all drains provided with a running trap. This pipe shall be not less than four inches in diameter, entering the drain on the house side of and near said running trap, and this may lead to the outer air, opening at any convenient place, at least fifteen feet from the nearest window, door, or opening of fresh air conduit to heating apparatus, and be furnished with a suitable ventilating cap.

V. All soil, drain, waste, and supply pipes shall be concentrated as much as possible, protected from exposure, and, in general, so located as to be accessible for inspection by the health officer or board of health, at any time. They shall all be extra heavy.

Drip or overflow pipes, from safes, or from supply tanks, or cisterns, also waste pipes from refrigerators, shall not be directly connected with the sewer, but shall discharge over other trapped fixtures, or into the open air.

When rain water leaders are connected with the house drains or sewers, they shall be trapped beneath the ground, with deep seal trap, and if placed within the house shall be made of extra heavy cast iron, with leaded joints.

All iron pipes may be coated, outside and inside, with coal tar, applied hot, or some other approved equivalent. This application shall not be made unless pipes have been tested and examined at the pipe foundry for sand holes, flaws, or other defects.

VI. Water closets shall not be located in any room which has no direct communication with the external air, either by window or an air shaft of sufficient size, except upon permission of the health officer in writing.

VII. Every water closet, urinal, sink, basin, bath, and set of wash trays, or tubs, must be separately and effectively trapped, and each trap ventilated, or an approved antisiphon trap used. (Such traps are the "Puro," "Sanitas," "Ideal," "Hydric,"

and the McClelland antisiphon attachment.) Traps must be placed as near the fixtures as practicable, and in no case, except as hereafter noted, shall the trap be more than one foot from the fixture. In no case shall the waste from a bath tub or other fixture be connected with the water closet trap. The discharge from any plumbing fixture shall not pass through more than one trap before reaching the house sewer. When an antisiphon trap is used, it may be placed farther than one foot from the fixture in order to facilitate the flushing of the trap. Where antisiphon traps are used on fixtures located more than six feet from a vent stack, continuous venting for the waste must be provided.

VIII. Cellars shall not be connected with the house drain unless necessary. When so connected, they shall be effectively trapped and means provided to maintain a seal.

IX. No privy vault or sink or water closet range shall be allowed in any cellar or basement of a schoolhouse; nor shall the general privy accommodations of a tenement or lodging house be located in the cellar or basement. For water closet fixtures located in the basement of schoolhouses only individual closets are permissible. Continuous water closet troughs or ranges may be used in detached water closet pavilions.

The general water closet accommodations of tenements, lodging houses, depots, offices, and business buildings, or any buildings in which said accommodations are permitted to be used by the public, shall be constructed and located so that no nuisance may be created affecting the public health; all public urinals in such toilet rooms shall be floored and lined with material impermeable to water.

X. Pan, valve, and plunger closets shall not be used. Washout closets shall be permitted only if they are made without vent horn.

Water closet traps, if vented, shall have the vent connected with the lead bend under the floor.

Water closets and urinals shall not be flushed by a direct connection with the water supply pipes. They must either have separate cisterns, the water from which shall not be used for other purposes, or have flushometer valves supplied from a special tank provided for that purpose.

XI. Any person feeling aggrieved by any order of the health officer, issued under the preceding ten rules, may appeal therefrom to the board of health of the city or village, by notice to that effect in writing, to be filed with the secretary of said board, within forty-eight hours after the service of the order. And the said secretary shall forthwith notify the members of the board of health of such appeal.

And further proceedings shall be stayed a reasonable time pending the hearing of said appeal; but no proceedings had under the rule shall contravene the provisions of Sections 4677, 4678, 4679, and 4680, V. S., or conflict in any way with the provisions of Section 3 of Act No. 91 of the Laws of 1900.

And pending such appeal, no work shall be done by the appellant, contrary to the provisions of Rules I to IX inclusive, aforesaid.

Upon hearing, the order of the health officer may be sustained or disapproved, by majority vote of the full board of health, and their decision shall be final.

In case the order is sustained, the appellant shall be allowed forty-eight hours after the decision of the board is rendered, in which to enter upon a compliance with the provisions of said order.

In case of a disapproval of such order by the board, the order shall, by virtue thereof, be vacated, and no similar order shall issue against the same party, except as provided in Sections 4678 and 4679, V. S.

STATE BOARD OF HEALTH,

June, 1908

[HENRY D. HOLTON, M.D., Secretary

CHAPTER XXI

PURE DRUGS AND FOODS*

Historical and general considerations — Federal and state legislation — Rulings — Administration of laws — Regulations — As the law affects (a) manufacturers, (b) wholesalers, (c) retailers, (d) physicians — Official drugs — Non-official drugs — Patent and proprietary medicines — Imported preparations — Drugs in general trade — Toilet preparations — Medicated beverages — Mineral waters — Foods claimed to be medicinal — Drugs not in interstate trade — Denaturing — Poisons — Cold storage.

Drugs and Their Preparations. A paper written by Prof. J. Uri Lloyd.

Food Standards. (1) Animal products, (2) Vegetable products, (3) Preservatives and coloring matters — Some commercial illustrations.

Literature consulted — Reports of the Chemist, U. S. Dept. of Agriculture — The whole issue of circulars, food inspection decisions, and notices of the judgment of the Federal Department — The pure food and drug literature issued by the state boards of health — "The National Pure Food and Drug Act," by John Uri Lloyd — Many journal articles.

NOTE.— Although written later, it was not practicable for the authors of this paper to verify rulings issued after October 1, 1909. It is not believed that the integrity of the article will be vitiated in any manner, except technical details not interesting physicians, by any new rulings excepting the vexed question of chemical preservatives and those made necessary by advances in chemical science and new assay processes. Manufacturers should not base their practice upon *this* or any other paper, but should apply directly to the Department.

IN order to smooth out what may appear as "the wire-edge of law" in the body of this paper upon pure drugs and foods, permit us to say that the editor made two trips to Washington and has witnessed the workings of the Bureau of Chemistry, and what he saw confirms the following extract from a letter under date of April 20, 1909:

The vast improvement, however, which has taken place without recourse to legal processes, and the general ethical effects are perhaps the most important results of the law.

Respectfully,
(Signed) H. W. WILEY, *Chief*

Historical and general considerations.— While this country was sparsely settled and the medication of the good old country doctor was nearly as domesticated as was the food supply of his patients, there was no need for a "food and drug act" nor for fear of an ignorant doctor half killing one with drugs he did not know enough about to perceive that their "chemical formula" spelled POISON, nor yet for a well-informed physician to have bad results because the manufacturer's label lied.

But, as has been well said by Professor Lloyd, the old style family medicine business was insidiously usurped by the man who claimed the right to dose his fellowmen with harmful drugs, with slave-breeding narcotics, with demoralizing stimulants, without let or hindrance, by reason of the American idea that restriction, even in this

*By J. Uri Lloyd, Phar. M. and the editor.

direction, meant loss of liberty to an individual. Liberty to do right was thus perverted into license to do wrong. America became a land of medical self-dosing freedom, to whosoever cared to mislead, to abuse, to mistreat her citizens under any guise whatever, that related to either harmful or worthless medication. . . . The evil culminated when in the closing years of the last century, the German synthetics, the heart depressants, the coal-tar energetics . . . were made into tablets, pills, and powders by charlatans, and were sold by whosoever cared to do so, in death-dealing quantities, as headache cures, etc., to whoever would innocently take them. Then arose an army of Americans demanding that in these directions the term liberty be restricted. . . .

The mighty monopolistic establishments that now appeared in the field, *food factories*, found it desirable to utilize the art of the chemist and the maker of medicines in the line of food preservatives. His elbows touched those of the maker of heart paralyzers. The chemist's art became also a necessity with the concoctors of the insidious artificial drinks and narco-alcoholics. . . .

Some of the powerful American magazines, as well as many of the more creditable newspapers, united with temperance people, physicians, and other philanthropists, to throw themselves into a crusade designed to better conditions, and in this cause the Agricultural Department at Washington and the Internal Revenue Department became integral parties. . . . Consequently, June 30, 1906, the bill known as "The National Pure Food and Drug Act" became a law of the United States.

Such were its outreaches, that its authors scarcely realized the extent of its ramifications. Industries long established and seemingly unconcerned were destined to be revolutionized. . . .

During the two months following the passage of the bill . . . neither pharmacist, physician, importer, nor dispenser of drugs gave the law the least concern. None seemed to appreciate the fact that January 1, 1907, was approaching, when, under the law's exactions, they would all come under the surveillance of the government. In September, 1906, came the awakening. The committee appointed by the government, Dr. H. W. Wiley, chairman, advertised that they would meet in New York and confer publicly with interested parties. They also announced their tentative rulings, showing who and what were concerned. Like the shock of a volcanic explosion came these rulings to the abruptly awakened sleepers. Pharmacists, liquor men, importers, manufacturing druggists, proprietary medicine men, and participants in connected and yet separate interests now perceived their dilemma. They took the first train to New York. . . .

But the aim is not to *persecute* any one, rather, to *help* those *aiming to do right*.

Naturally there was a degree of friction at first, but it is to the credit of American manufacturers that all of the representative ones among them are cheerfully complying with the law. The ones who do not comply are not entitled to sympathy when they get into trouble except in the instances when they are taken advantage of by makers or venders of defective crude materials. The intent and requirements of the law are so well understood at present that its administration is much simplified.

Federal legislation is now fully represented by this law and by the regulations of co-ordinate laboratories of the government.

Sections 1, 2, and 3 provide penalties for the violation of provisions following and limit the scope of the law to the District of Columbia, the territories and dependencies of the United States, traffic with foreign countries (under exceptions and limitations) and between the states and territories of

the United States. Adulteration and misbranding within the meaning of the act are prohibited. The secretaries of the treasury, agriculture, and commerce and labor shall make uniform rules for collection and examination of goods in unbroken packages. Section 4 provides for the examination of specimens in the bureau of chemistry, the notification and hearing of the offending party and the provisions for suit in case of proper findings for the bringing of the indictment. Section 5 further provides for the legal processes. Section 6 recognizes the United States Pharmacopœia and the National Formulary and defines the meaning of the words "drug" and "food," and includes simple, mixed, and compounded foods and drugs. Section 7 defines adulteration at length (we will touch upon this under the several substances involved). Section 8 defines what shall be deemed as misbranding. Section 9 provides for a guarantee by the maker or wholesaler and defines the liability of the retailer. Section 10 provides for libel process and sale or destruction of condemned goods. Section 11 provides certain legal processes, and under what conditions goods may be imported. Section 12 defines the word "territory" and the word "person." Section 13 states when the law will be in force.

A casual reading of this short act would give little idea of what it really means under the definitions prescribed for the several words involved. Hence, "The Food and Drug Act" need not be reproduced here except as to the outline above.

State legislation is being rapidly brought into line with the federal laws and regulations. Many of the states have but partially legislated, but nearly all recent state enactments are directly in the line of the federal act. To the requirements of the federal act must be added, for the state, such provision for collection of samples, their examination, and such legal processes as the state may provide specifically, and the officials must be named who have jurisdiction in the premises. It would be utterly unprofitable to consider the regulations short of the standard set by the federal government.

Rulings by the courts and verdicts by juries have been so numerous and the United States has brought so many suits that the legal status and integrity of the federal and state food and drug laws may be regarded as determined.

Administration of laws.—This is an important matter. So far as it may affect any reader of this book, the federal inspector may come into touch with him. The person owning or conducting the place or selling the goods inspected has certain legal rights defined in the following:

FOOD INSPECTION DECISION 69

INSPECTION OF FOOD AND DRUGS AND IDENTIFICATION OF INSPECTORS

In connection with the enforcement of the food and drugs act, June 30, 1906, inspectors of the Bureau of Chemistry will visit establishments in which food and drug products are manufactured, stored, or sold. They will make report to the bureau regarding conditions of manufacture, and will take samples wherever it is desired, paying the regular prices for such samples.

In case the report of the inspector, or the examination of the sample taken by him, discloses a violation of the law, no action will be taken until the dealer or manufacturer has been notified and afforded a hearing before the Board of Food and Drug Inspection. The preliminary hearing in each case may be held before the chief of the laboratory making the examination. In case of an adverse decision the recommendation of the chief of the laboratory, together with a digest of the testimony, must be submitted to the Board of Food and Drug Inspection for final action.

According to Regulation 5 (a) —

The parties interested therein may appear in person or by attorney, and may propound proper interrogatories and submit oral or written evidence to show any fault or error in the findings of the analyst or examiner.

It is held that the interested parties need not necessarily appear in person or by attorney, but, instead, may submit a brief to the Board of Food and Drug Inspection stating their side of the case.

If the results of the inspection and examination indicate that the law has not been violated, or if it is believed by the Department that prosecution is unwarranted because of irregularity of sample, or for other reason, the dealer will be notified that no further action will be taken with reference to that sample.

No information will be given in any case by an inspector or branch laboratory of the Bureau of Chemistry regarding the report of an inspection of a factory or the result of an analysis. No statement will be made at any time except as mentioned above regarding the analysis of a sample that is found to be in accordance with the law. No certificate of analysis will be given, and no report other than the notice of a violation of the law referred to above. *Requests for reports upon samples taken will be answered by a copy of this decision.*

The following form for the identification of inspectors has been adopted:

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., 190

This is to certify that, whose photograph appears opposite, is authorized to inspect establishments manufacturing and dealing in food and drugs and products entering into their manufacture, under the food and drugs act, June 30, 1906.

This authorization expires

(Date)

.....
(Secretary)

In addition to the above, the form includes a photograph of the inspector, the whole bound in a stiff cover.

The other matters involved in administration are laboratory investigation and legal detail, and not particularly of interest in the present study of the question.

In a state a little more is involved. Taking Vermont as an example, Regulation II declares: "The enforcement of this law is made the duty of the state board of health. The state board of health, the director, a chemist or inspector of the laboratory of hygiene, and the health officers of the several towns and cities are food and drug inspectors."

They have defined duties as to inspection and taking of samples. Samples taken are marked with the following gummed stickers:

THE STATE OF VERMONT

[COLLECTOR'S RECORD]

Town
 Date of collection 190
 Owner
 Article
 Brand
 Manufacturer.....
 Collected by.....

[PASTER]

Town
 Date of collection 190
 Owner
 Article
 Brand
 Manufacturer.....
 Collected by

BOARD OF HEALTH

Section 8 provides: Inspectors shall conduct their examinations quietly and in such manner that no unnecessary antagonism will be aroused against their work. They will remember always that it is the policy of the board of health to co-operate with manufacturers, wholesalers, and retailers in securing pure goods.

Regulation 7 provides: Unless for some reasons impracticable the methods of analysis employed shall be those prescribed by the Association of Official Agricultural Chemists.

Regulations.— As provided for in Section 3 of the federal law, regulations have been issued, the more interesting features of which we will touch upon.

The term “original unbroken package” includes both the wholesale and the retail package. Samples are collectable only by authorized persons and under regulations, so far as the vender is concerned, somewhat like those of Vermont, and the analytical methods are the same as are those of that state. Hearings are private and are confined to matters of fact. Drugs bearing the U. S. P. or the N. F. names must conform thereto. If drugs so named are branded to show a different standard of strength, quality, or purity, it shall not be regarded as adulterated if the label tells the truth. Dealers are not liable to prosecution for the sale of goods containing the “guaranty” of the maker or jobber under their serial number. Such guaranty and serial number places the responsibility upon the person or firm under whose name it is registered. The regulations as concern adulteration will be sufficiently discussed under a separate heading. Misbranding is regulated (Reg. 17) as follows:

REGULATION 17. LABEL

(Section 8)

(a) The term “label” applies to any printed, pictorial, or other matter upon or attached to any package of a food or drug product, or any container thereof subject to the provisions of this act.

(b) The principal label shall consist, first, of all information which the food and drugs act, June 30, 1906, specifically requires, to wit, the name of the place of manufacture in the case of food compounds or mixtures sold under a distinctive name; statements which show that the articles are compounds, mixtures, or blends; the words “compound,” “mixture,” or “blend,” and words designating substances or

their derivatives and proportions required to be named in the case of foods and drugs. All this information shall appear upon the principal label, and should have no intervening descriptive or explanatory reading matter. Second, if the name of the manufacturer and place of manufacture are given, they should also appear upon the principal label. Third, preferably upon the principal label, in conjunction with the name of the substance, such phrases as "artificially colored," "colored with sulphate of copper," or any other such descriptive phrases necessary to be announced should be conspicuously displayed. Fourth, elsewhere upon the principal label other matter may appear in the discretion of the manufacturer. If the contents are stated in terms of weight or measure, such statement should appear upon the principal label, and must be couched in plain terms, as required by Regulation 29.

(c) If the principal label is in a foreign language, all information required by law and such other information as indicated above in (b) shall appear upon it in English. Besides the principal label in the language of the country of production, there may be also one or more other labels, if desired, in other languages, but none of them more prominent than the principal label, and these other labels must bear the information required by law, but not necessarily in English. The size of the type used to declare the information required by the act shall not be smaller than eight-point (brevier) capitals: *Provided*, That in case the size of the package will not permit the use of eight-point type, the size of the type may be reduced proportionately.

(d) Descriptive matter upon the label shall be free from any statement, design, or device, regarding the article or the ingredients or substances contained therein, or quality thereof, or place of origin, which is false or misleading in any particular. The term "design" or "device" applies to pictorial matter of every description, and to abbreviations, characters, or signs for weights, measures, or names of substances.

(e) An article containing more than one food product or active medicinal agent is misbranded if named after a single constituent.

In the case of drugs the nomenclature employed by the United States Pharmacopœia and the National Formulary shall obtain.

(f) The use of any false or misleading statement, design, or device appearing on any part of the label shall not be justified by any statement given as the opinion of an expert or other person, nor by any descriptive matter explaining the use of the false or misleading statement, design, or device.

The above regulation is important to the physician, while the other regulations governing misbranding will be touched upon under Manufacturers and Wholesalers, in the next subdivision of this chapter. Articles sold without a label must be truly described and sold for just what they really are. The name of any substituted substance must appear upon the label. When waste materials are made up into goods for sale, the packages must bear a label — "pieces," "stems," "trimmings," or some similar appellation. "Mixtures" and "compounds" shall not be imitations of some other article. Regulation 28 will enter into the discussion of U. S. P. drugs. Statements of weights or measures upon packages are not required, but when they are made they must be true to the facts. Regulations 31, 32, and 33 have to do with imported goods discussed under a separate heading, as is also Regulation 34, upon denaturing. The rest of the regulations have to do with processes and exporting. It may be well to call attention to Regulation 39.

These regulations shall not apply to domestic meat and meat food products which are prepared, transported, or sold in interstate or foreign commerce under the meat-inspection law and the regulations of the Secretary of Agriculture made thereunder.

Persons wishing to consult the regulations in full will find them in "Circular No. 21, Revised," and entitled, "Rules and Regulations for the Enforcement of the Food and Drugs Act." This circular also contains a copy of the act.

As the law affects manufacturers.—Dr. Wiley's report for 1908, says:

As a rule the inspectors have been received with great courtesy by the manufacturers, and have received full inspection privileges. This sympathetic co-operation of the manufacturers has been manifested in many other ways. One of the most gratifying results obtained during the year has been the abandonment of the position of hostility which many manufacturers up to that time held, and an assumption of hearty co-operation, not only with the inspection work of the department, but also with the broadest views respecting the wholesomeness of substances added to foods. A large number of prominent manufacturers during the year entirely abandoned the use of any kind of preservatives, and openly announced their adhesion to the doctrine that drugs should not be placed in foods. Although there have been no suits brought so far involving the addition of a chemical preservative to a food, the practice has been openly discredited by so many first-class manufacturers as to warrant the statement that the cause of pure food, in so far as chemical preservatives are concerned, has been firmly established.

As a matter of fact, the manufacturers are subject to many of the regulations, but Nos. 18 to 27 particularly enter into the business of manufacturing. No. 17 has been reproduced under another heading, but it also concerns manufacture. Nos. 18 and 19 are here reproduced:

REGULATION 18. NAME AND ADDRESS OF MANUFACTURER

(Section 8)

(a) The name of the manufacturer or producer, or the place where manufactured, except in case of mixtures and compounds having a distinctive name, need not be given upon the label, but if given, must be the true name and the true place. The words "packed for —," "distributed by —," or some equivalent phrase, shall be added to the label in case the name which appears upon the label is not that of the actual manufacturer or producer, or the name of the place not the actual place of manufacture or production.

(b) When a person, firm, or corporation actually manufactures or produces an article of food or drug in two or more places, the actual place of manufacture or production of each particular package need not be stated on the label except when in the opinion of the Secretary of Agriculture the mention of any such place, to the exclusion of the others, misleads the public.

REGULATION 19. CHARACTER OF NAME

(As amended by F. I. D. 84, January 31, 1908, taking effect February 10, 1908)

(Section 8)

(a) A simple or unmixed food or drug product not bearing a distinctive name should be designated by its common name in the English language; or if a drug, by any name recognized in the United States Pharmacopœia or National Formulary. No further description of the components or qualities is required, except as to content of alcohol, morphine, etc.

(b) The use of a geographical name shall not be permitted in connection with a food or drug product not manufactured or produced in that place, when such name indicates that the article was manufactured or produced in that place.

(c) The use of a geographical name in connection with a food or drug product will not be deemed a misbranding when by reason of long usage it has come to represent a generic term and is used to indicate a style, type, or brand; but in all such cases the state or territory where any such article is manufactured or produced shall be stated upon the principal label.

(d) A foreign name which is recognized as distinctive of a product of a foreign country shall not be used upon an article of domestic origin except as an indication of the type or style of quality or manufacture, and then only when so qualified that it cannot be offered for sale under the name of a foreign article.

The other regulations (20 to 27) are less important, but define what is meant by a "distinctive name," "compounds," "blends," and "imitations." They apply largely to the liquor trade. The other sections lay down rules for branding and substitution.

The adulteration and misbranding of goods might be entered into at length, but it impresses me that under the section upon "Food Standards," the adulteration and misbranding may be considered more understandingly for the reader not directly concerned with the legal phases of health work.

Quite an important matter connected with the manufacture of foods is the sanitation of factories. This matter is subject to the police power of the states and the federal government cannot regulate it to any efficient degree. Several states have legislated upon the subject, among the most recent being the state of California. We here reproduce this excellent law, passed in 1909, and commend it as a model. However, it would have been improved if the words defined had specifically included beers and liquors, cigars, cigarettes and tobacco products.

The people of the state of California, represented in senate and assembly, do enact as follows:

SECTION 1. Every building, room, basement, or cellar, occupied or used as a bakery, confectionery, cannery, packing house, slaughter house, restaurant, hotel, grocery, meat market, or other place or apartment, used for the production, preparation for sale, manufacture, packing, storage, sale, or distribution of any food, shall be properly lighted, drained, plumbed, and ventilated, and conducted with strict regard to the influence of such conditions upon the health of the operatives, employees, clerks, or other persons therein employed, and the purity and wholesomeness of the food therein produced, kept, handled, or sold; and for the purpose of this act the term

"food" shall include all articles used for food, drink, confectionery, or condiment, whether simple or compound, and all substances and ingredients used in the preparation thereof.

SEC. 2. The floors, side walls, ceilings, furniture, receptacles, utensils, implements, and machinery of every establishment or place where food is manufactured, packed, stored, sold, or distributed, shall at no time be kept in an unclean, unhealthful, or unsanitary condition; and for the purposes of this act, unclean, unhealthful, and unsanitary conditions shall be deemed to exist if food in the process of manufacture, preparation, packing, storing, sale, or distribution is not securely protected from flies, dust, dirt, unsanitary conditions, and as far as may be necessary by all reasonable means from all other foreign or injurious contamination; and if the refuse, dirt, and the waste products subject to decomposition and fermentation incident to the manufacture, preparation, packing, storing, selling, and distributing of food are not removed daily; and if all trucks, trays, boxes, buckets, and other receptacles, chutes, platforms, racks, tables, shelves, and all knives, saws, cleavers, and all other utensils, receptacles, and machinery, used in moving, handling, cutting, chopping, mixing, canning, and all other processes used in the preparation of food are not thoroughly cleaned daily; and if the clothing of operatives, employees, clerks, and other persons therein employed, is unclean, or if they dress or undress or leave or store their clothing therein.

SEC. 3. The side walls and ceilings of every bakery, confectionery, hotel, and restaurant kitchen shall be well plastered, or ceiled with metal or lumber, or shall be oil painted or kept well lime washed, or otherwise kept in a good sanitary condition, and all interior woodwork of every bakery, confectionery, hotel, and restaurant kitchen shall be kept well oiled or painted with oil paint, and be kept washed clean with soap and water, or otherwise kept in a good sanitary condition; and every building, room, basement, or cellar, occupied or used for the preparation, manufacture, packing, storage, sale, or distribution of food, shall have an impermeable floor, made of cement, or tile laid in cement, brick, wood, or other suitable non-absorbent material which can be flushed and washed clean with water.

SEC. 4. The doors, windows, and other openings of every food producing or distributing establishment, where practicable, shall be fitted with stationary or self-closing screen doors and wire window screens, of not coarser than fourteen mesh wire gauze.

SEC. 5. Every building, room, basement, or cellar occupied or used for the preparation, manufacture, packing, canning, sale, or distribution of food shall have convenient toilet or toilet rooms, separate and apart from the room or rooms where the process of production, manufacture, packing, canning, selling, or distributing is conducted. The floors of such toilet rooms shall be of cement, tile laid in cement, wood, brick, or other non-absorbent material, and shall be washed and scoured daily. Such toilets shall be furnished with separate ventilating pipes or flues, discharging into soil pipes, or on the outside of the building in which they are situated. Lavatories and washrooms shall be adjacent to toilet rooms, and shall be supplied with soap, running water, and towels, and shall be maintained in a clean and sanitary condition. Operatives, employees, clerks, and all persons who handle the material from which food is prepared, or the finished product, before beginning work, and immediately after visiting a toilet or lavatory shall wash their hands and arms thoroughly in clean water.

SEC. 6. Cuspidors for the use of operatives, employees, clerks, and other persons shall be provided, and each cuspidor shall be emptied and washed out daily with disinfectant solution and not less than five ounces of such solution shall be left in each cuspidor while in use. No operative, employee, clerk, or other person shall expectorate or discharge any substance from his nose or mouth on the floor or interior

side wall of any building, room, basement, or cellar where the production, manufacture, packing, storing, preparation, or sale of any food product is conducted.

SEC. 7. No person shall be allowed to, nor shall he, reside or sleep in any room of a bakeshop, public dining-room, hotel, or restaurant kitchen [or], confectionery, where food is prepared, produced, manufactured, served, or sold.

SEC. 8. No employer shall require, permit, or suffer any person to work, nor shall any person work, in a building, room, basement, cellar, place, or vehicle occupied or used for the production, preparation, manufacture, packing, storage, sale, distribution, or transportation of food, who is afflicted or affected with any venereal disease, smallpox, diphtheria, scarlet fever, yellow fever, tuberculosis, consumption, bubonic plague, Asiatic cholera, leprosy, trachoma, typhoid fever, epidemic dysentery, measles, mumps, German measles, whooping-cough, chicken pox, or any other infectious or contagious disease.

SEC. 9. The members of the state board of health, inspectors and agents appointed by said board, and all local health officers and inspectors, shall have full power at all times to enter every building, room, basement, cellar, or any place occupied or used, or suspected of being occupied or used, for the production, manufacture, preparation, storage, sale, or distribution of food, and to inspect the premises and all utensils, implements, receptacles, fixtures, furniture, and machinery used as aforesaid, and if, upon inspection, any such building, room, basement, cellar, or any such place, vehicle, employer, operative, employee, clerk, driver, or other person is found to be in violation or violating any of the provisions of this act, or if the production, preparation, manufacture, packing, storing, sale, or distribution of food is being conducted in a manner detrimental to the health of the employees or operatives or to the character or quality of the food therein being produced, manufactured, packed, stored, sold, distributed, or conveyed, the officer or inspector making the examination shall at once make a written report of the same to the district attorney of the county, who shall prosecute all persons violating any of the provisions of this act, and also to the state board of health. The state board of health, from time to time, as in its discretion it may determine, may publish such reports in its monthly bulletin.

SEC. 10. All buildings, rooms, basements, cellars, and other places and things kept, maintained, or operated, or which are in violation of the provisions of this act or any of them, and all food produced, prepared, manufactured, packed, stored, kept, sold, distributed, or transported in violation of the provisions of this act or any of them, are hereby declared to be public nuisances, dangerous to health. Such nuisances may be abated or enjoined, in an action brought for that purpose by the local or state board of health, or they may be summarily abated in the manner provided by law for the summary abatement of public nuisances dangerous to health.

SEC. 11. Any person, firm, or corporation, whether as principal or agent, employer or employee, who violates any of the provisions of this act shall be guilty of a misdemeanor, and each day that conditions or actions, in violation of this act, shall continue, shall be deemed to be a separate and distinct offense, and for each offense, upon conviction, he shall be punished by a fine of not less than twenty-five dollars, nor more than five hundred dollars, or shall be imprisoned in the county jail for a term not exceeding six months, or by both such fine and imprisonment.

Wholesalers and jobbers.—These men should not send out a package bearing an old label used before the act went into effect, and it is not safe for them to send out goods bearing the "stickers" that were allowed previous to October 1, 1907. All packages of the jobber sold for interstate trade or in

any of the territories must conform to law, and when required have the alcohol and assay content plainly stated. If a jobber opens a package his billed fragment becomes an original package and must be labelled according to law and *he* becomes responsible therefor. Physicians should not ask the jobber to divide packages. This matter may be very involved and the Attorney General has passed upon its several phases, and I would advise involved persons to consult "Food Inspection Decision 83," and also the same "40 to 43," and "70 to 72." The discussion of details here would be too lengthy.

Owing to outrageous abuse of the wording of the guaranty on labels and the fact that unprincipled scoundrels advertised their goods in such a way that it appeared that they were guaranteed by the United States Government, the following has been issued:

As a solution of the question, the Board recommends that the guaranty legend be changed so as to show plainly that the guaranty is that of the manufacturer and not of the government, that the old form of labels now in use representing guaranties already filed with the department of agriculture shall be recognized for a term of two years, and that for all guaranties filed with the department of agriculture on and after January 1, 1909, the guaranty legend shall read "Guaranteed by [insert name of guarantor] under the food and drugs act, June 30, 1906."

Accordingly the following amendment is proposed to Regulation 9 of the Rules and Regulations for the enforcement of the food and drugs act:

Section *b* of Regulation 9 is hereby amended to read as follows:

(*b*) A general guaranty may be filed with the secretary of agriculture by the manufacturer or dealer and be given a serial number, which number shall appear on each and every package of goods sold under such guaranty with the words "Guaranteed by [insert name of guarantor] under the food and drugs act, June 30, 1906."

This amendment shall become and be effective on and after January 1, 1909. Labels bearing the form of guaranty legend provided in the original regulations and representing guaranties now on file with the department of agriculture may be used for a period of two years, but it is suggested that, as new labels are prepared, the change in the form of guaranty legend should be made.

Retailers.—Pharmacists who dispense for interstate business have to conform to many requirements. Others are largely protected by the guaranty of their jobber. It is well for them to purchase in unbroken packages and to carefully cork all preparations to prevent evaporation of volatile constituents. If the pharmacist makes up any specialties, he better append the serial guaranty label and conform to the law in every particular, as he never knows when a package may go over a state line. State laws may be in force and the pharmacist must conform to them very fully. He should procure a copy of the laws of his state. He should be very careful of his purchases of confectionery, soda syrups, and ice cream. Many jobbers fully protect their customers, and it is to the advantage of the druggist to buy from such houses.

Physicians should read the following:

(F. I. D. 57)

PHYSICIANS' PRESCRIPTIONS

THE STATUS OF PACKAGES COMPOUNDED ACCORDING TO PHYSICIANS' PRESCRIPTIONS
AND ENTERING INTO INTERSTATE COMMERCE

Packages resulting from the compounding of physicians' prescriptions under the food and drugs act are the subject of many queries, of which the following are representative:

If a druggist compounds a physician's prescription and sends it into an adjoining state, will it be necessary to state upon the label the amount of alcohol, morphine, etc., that may be present?

Supposing a regularly licensed practicing physician has patients located in various states of the Union and supplies medicines to them through the mails, by express, and otherwise, do such packages come under the provisions of the law, and, if so, can the required information be given in pen and ink on the label?

We treat drug addictions on a very gradual tonic treatment reduction plan. For instance, if John Doe writes for information as to the home treatment for his addiction, I send him a symptom blank which contains, among other questions, an inquiry as to the kind of drug he uses, how he uses it, the length of time he has used it, etc. In addition to giving me a complete history of his case, he states he is using ten grains of sulph. of morphine (each twenty-four hours), hypodermically or internally, as the case may be. In prescribing in his case I immediately put him on just one half of the amount he reports as his daily allowance, combining same with a bitter tonic.

It is necessary for the reduction in drug cases to be made without the patient's knowledge. It is, of course, understood by all physicians that you cannot trust a drug habitué to properly make his own reductions, for, as a matter of fact, if he knew to what extent I was reducing his daily allowance of opiates, he would imagine the reduction too rapid, he would get frightened, and would take to his former drug for relief. Treatment prepared in this way I do not think would come under the head of a proprietary preparation or a patent medicine, as I prescribe the contents of each bottle to meet the requirements of each individual patient. All instructions as to the conduct of treatment and the use of auxiliary remedies are given by letter; consequently there are no printed labels or cartons containing any claims concerning the efficacy of this treatment.

I would be pleased to have you inform me whether in your opinion I would be violating the pure-food law in any manner, shape, or form should I continue to label my preparations as I am now doing, and in having them prepared in — and forwarded direct to my patients in this and other states.

If a package compounded according to a physician's prescription be shipped, sent, or transported from any state or territory or the District of Columbia to another state or territory or the District of Columbia by a compounder, druggist, physician, or their agents, by mail, express, freight, or otherwise, the label upon such package is required to bear the information called for by Congress. If, however, the patient himself, or a member of his household, or the physician himself carries such package across a state line, and such package is not subject to sale, it is held that such package need not be marked so as to conform with the law, because such a transaction is not considered one of interstate commerce.

The package may be marked so as to comply with the act by either stamp, pen, and ink, or typewriter, provided all such written matter is distinctly legible and on the principal label, as prescribed in Regulation 17.

JAMES WILSON, *Secretary of Agriculture*.

WASHINGTON, D. C., March 13, 1907.

Much of the dispensing by physicians is not *selling* drugs, and the bedside giving of medicine or the writing of prescriptions and sending them across a state line is not involved in the law. There are a number of so-called "physicians' supply houses," who sell within a state drugs that would not meet the requirements of the federal law. Physicians will do well to buy only such drugs as are labelled according to the federal law. Especially is this important in states with food and drug laws of their own.

Official drugs.—As has been stated, the U. S. P. and the N. F. are recognized. The following regulations are of the greatest importance and physicians should be familiar with them:

REGULATION 28. SUBSTANCES NAMED IN DRUGS OR FOODS
(Section 8. Second under "Drugs;" second under "Foods")

(a) The term "alcohol" is defined to mean common or ethyl alcohol. No other kind of alcohol is permissible in the manufacture of drugs except as specified in the United States Pharmacopeia or National Formulary.

(b) The words alcohol, morphine, opium, etc., and the quantities and proportions thereof, shall be printed in letters corresponding in size with those prescribed in Regulation 17, paragraph (c).

(c) A drug or food product except in respect of alcohol, is misbranded in case it fails to bear a statement on the label of the quantity or proportion of any alcohol, morphine, opium, heroin, cocaine, alpha or beta eucaine, chloroform, cannabis indica, chloral hydrate, or acetanilide, or any derivative or preparation of any such substances contained therein.

(d) A statement of the maximum quantity or proportion of any such substances present will meet the requirements, provided the maximum stated does not vary materially from the average quantity or proportion.

(e) In case the actual quantity or proportion is stated it shall be the average quantity or proportion with the variations noted in Regulation 29.

(f) The following are the principal derivatives and preparations made from the articles which are required to be named upon the label:

ALCOHOL, ETHYL: (*Cologne spirits, grain alcohol, rectified spirits, spirits, and spirits of wine.*)

Derivatives:

Aldehyde, ether, ethyl acetate, ethyl nitrite, and paraldehyde.

Preparations containing alcohol:

Bitters, brandies, cordials, elixirs, essences, fluidextracts, spirits, syrup, tinctures, tonics, whiskies, and wines.

MORPHINE, ALKALOID:

Derivatives:

Apomorphine, dionine, peronine, morphine acetate, hydrochloride, sulphate, and other salts of morphine.

Preparations containing morphine or derivatives of morphine:

Bougies, catarrh snuff, chlorodyne, compound powder of morphine, crayons, elixirs, granules, pills, solutions, syrups, suppositories, tablets, triturations, and troches.

OPIMUM, GUM:

Preparations of Opium:

Extracts, denarcotized opium, granulated opium, and powdered opium, bougies, brown mixture, carminative mixtures, crayons, Dovers powder, elixirs, liniments, ointments, paregoric, pills, plasters, syrups, suppositories, tablets, tinctures, troches, vinegars, and wines.

Derivatives:

Codeine, alkaloid, hydrochloride, phosphate, sulphate, and other salts of codeine.

Preparations containing codeine or its salts:

Elixirs, pills, syrups, and tablets.

COCAINE, ALKALOID:

Derivatives:

Cocaine hydrochloride, oleate, and other salts.

Preparations containing cocaine or salts of cocaine:

Coca leaves, catarrh powders, elixirs, extracts, infusion of coca, ointments, paste pencils, pills, solutions, syrups, tablets, tinctures, troches, and wines.

HEROIN:

Preparations containing heroin:

Syrups, elixirs, pills, and tablets.

ALPHA AND BETA EUCAINE:

Preparations:

Mixtures, ointments, powders, and solutions.

CHLOROFORM:

Preparations containing chloroform:

Chloranodyne, elixirs, emulsions, liniments, mixtures, spirits, and syrups.

CANNABIS INDICA:

Preparations of cannabis indica:

Corn remedies, extracts, mixtures, pills, powders, tablets, and tinctures.

CHLORAL HYDRATE (*Chloral*, U. S. Pharmacopœia, 1890):

Derivatives:

Chloral acetophenonoxim, chloral alcoholate, chloralamide, chloralimide, chloral orthoform, chloralose, dormiol, hypnal, and uraline.

Preparations containing chloral hydrate or its derivatives:

Chloral camphorate, elixirs, liniments, mixtures, ointments, suppositories, syrups, and tablets.

ACETANILIDE (antifebrine, phenylacetamide):

Derivatives:

Acetphenetidine, citrophen, diacetanilide, lactophenin, methoxyacetanilide, methylacetanilide, para-iodoacetanilide, and phenacetine.

Preparations containing acetanilide or derivatives:

Analgesics, antineuralgics, antirheumatics, cachets, capsules, cold remedies, elixirs, granular effervescing salts, headache powders, mixtures, pain remedies, pills, and tablets.

It must be remembered that *all* official drugs, whether embraced in this list of toxic substance or no, must be true to the official requirements so long

as they bear the official name and do not designate some separate standard of strength or purity.

Non-official drugs.— These drugs must comply with the regulations. The alcohol content and the identity and strength of the preparation must be stated. All that is demanded is simply a label that truly labels and describes.

From a reading of much state literature upon analyses there made, it appears that a large proportion of official and non-official drugs are sold that are very much below the standard. The state of New Hampshire, for instance, has analyzed many samples of drugs sold in grocery stores, such as camphorated oil, tincture iodine, and flavoring extracts. Their conclusion is that ninety per cent of such drugs fall below the standard and most of them very much below. The analyses of the Department at Washington show extensive adulteration, but less than formerly was the case.

Patent and proprietary medicines.— The writer has at hand a mass of data relative to patent and proprietary medicines, but considers it to be unfair to incorporate the same in this chapter for the reason that the manufacturers of these products are gradually improving their wares, and by the time this is printed, many substances I might denounce may have fully complied with both the letter and the spirit of the law. Beside that, physicians are so conversant with the facts concerning this class of products that it is hardly justifiable to take much space in giving details here.

These classes of medicines must have printed upon their labels the alcohol content as well as the amount of the drugs incorporated in the list we have given under the subheading, "Official Drugs." Some of the states have added to this list, notably Louisiana, which incorporates the following: nux vomica, gelsemium, physostigma, belladonna, scopola, hyoscyamus, stramonium, veratrum, staphysagria, aconite, colchicum, pilo carpus, pelletierine, conium, scoparius, digitalis, convallaria, strophanthus, male fern, santonin, ergot, gossypii, elaterium, croton oil, cantharides, antimony, mercury, arsenic, carbolic acid, cyanides, nearly all synthetics, and all of the compounds of these drugs. Patent medicines have pretty "hard sledding" in Louisiana.

Misbranding of a patent medicine subjects it to the law or the making of fraudulent claims. "Notice of Judgment No. 25" narrates the details of the case against "Harper's Cuforhedake Brane Fude," and which contained alcohol, acetanilid, caffeine, antipyrin, and bromides. It was advertised as containing no harmful ingredients and surely it could not be claimed to be a brain food. Therefore it was declared to be misbranded.

The report of the Massachusetts food and drug inspection for 1907 showed that out of one hundred and seventy-five proprietary medicines examined, ninety-one were classed as adulterated. Eight catarrh "cures" contained cocaine and the most of the other "cures" were just as fraudulent. The New Hampshire State Board of Health has shown up the patent medicine business for the fraudulent and semi-fraudulent thing it is unless stoutly restrained by the law. It is to be hoped that the Council of Pharmacy and Chemistry of the American Medical Association and the food and drug officials of the various states will get together and weed out the vampire dopes

of the land. The federal officials have been recently investigating the fraudulent prescription schemes by which some patent fraud is mixed by the druggist with sarsaparilla or whiskey or taraxicum or some other common drug. Some of the more honorable proprietary medicine men are truly observing the law and their goods have a more or less legitimate place in trade, but the fraudulent makers must be constantly watched.

Important preparations.— Probably one of the most important substances subject to import and with which the physician may have to do is meat. Persons living near the Mexican or Canadian border are vitally interested. Food Inspection Decision 73 is here reproduced:

INTERSTATE TRANSPORTATION OF IMPORTED MEATS AND MEAT-FOOD PRODUCTS

Regulations 64 of the Regulations Governing the Meat Inspection of the United States Department of Agriculture (Amendment No. 10 to B. A. I. Order No. 137) provides as follows:

Imported meats and meat-food products which have not been mixed or compounded with or added to domestic meats may be transported by any common carrier from one state or territory or the District of Columbia to any other state or territory if the packages containing them shall be marked "Inspected under the food and drugs act, June 30, 1906," and are so marked when received for transportation.

It is held that packing cases, boxes, or other coverings containing imported meats or meat-food products in the original true containers which have not been mixed or compounded with or added to domestic meats may be marked with the legend "Inspected under the food and drugs act, June 30, 1906," by the shipper. *The interstate transportation under this legend of domestic meats and meat-food products or of imported meats and meat-food products which have been mixed or compounded with or added to domestic meats will subject both the shipper and the carrier to heavy penalties.*

The physician who may wish to import drugs for his own use should remember that Decision 88 concludes with the following:

The provisions of the food and drugs act make no distinction between foods and drugs imported for consumption or free distribution by the importer and foods and drugs imported for trading purposes. The law provides that no misbranded or adulterated foods or drugs shall be admitted.

Notice is given that these so-called private importations will be subjected to the same restrictions as ordinary imports.

The law is not designed to interfere with persons selling their farm produce, etc., as here appears:

(F. I. D. 60)

MINOR BORDER IMPORTATIONS

Inquiry has frequently been made regarding the application of Regulation 33 (requiring a declaration to be attached to the invoice) to foods and drugs brought

into the United States in small quantities by farmers living near the border. One correspondent says:

Farmers along the border are in the habit of occasionally bringing in, in their own teams, maple sugar in small quantities, also butter and like articles of food products of their own raising, and offering the same for entry at the different officer on the frontier. . . . The main question is as to whether or not the affidavits and other proof required by the pure-food law shall be required in these instances of minor importations of this class of articles.

Considering the nature of these importations it is held that Regulation 33 does not apply to them, and that they may be imported without the declaration. Such products are subject to inspection, however, and if found to be in violation of the law will be excluded.

The decisions and the regulations governing large importations and the business of importing meats, drugs, etc., are ample, but need not especially concern us here.

Drugs in general trade.—As has been already stated, these drugs are usually below the U. S. P. standard. It is hardly safe for a dealer in a state possessing a pure food and drugs act of its own to sell anything labelled with a U. S. P. or N. F. name unless the label distinctly states the true strength of the preparation. It is permitted to sell drugs of lower than U. S. P. standard, *provided* they are so branded.

Toilet preparations.—The Twentieth Report of the State Board of Health of New Hampshire entered fully into this matter, and the chemists of the board made numerous analyses it is not necessary to reproduce here. Some of their conclusions are quoted:

Hair tonics may be divided into the following classes: (1) Mixtures of sulphur and glycerin, with or without lead acetate depending upon whether the preparation is to act as a dye as well as a tonic. The glycerin serves mainly as a vehicle for the sulphur, the latter acting as a germicide, and also, in conjunction with lead, gradually forming black lead sulphide. It should be borne in mind that lead acetate, taken by the mouth, is a violent poison; applied externally it is more or less readily absorbed, and may give rise to lead poisoning. (2) Dilute alcoholic solutions, with or without glycerin or borax, containing essential oils and some form of rubefacient, or counter-irritant. . . . (3) A more expensive class combines the constituents of (2) with the alkaloids of cinchona and, rarely, of nux vomica; these alkaloids are supposed to act as "tonics" in increasing the growth of hair.

Analysis showed these preparations to vary, some being honest as to advertised content, and some of the more prominent ones contained wood alcohol, while others contained lead.

Lotions, cosmetics, and cold creams were found to contain borax, ben-zoin, almond meal, lead, mercury, zinc, various oils, boroglycerin, and arsenic. Over half of the many examined were found to be either dangerous or fraudulent. Toilet waters were found containing wood alcohol and many other substances were fraudulent.

Medicated beverages.—Liquors will be considered under foods, since they are used principally as part of the daily ingesta. The report of the chemist, Department of Agriculture, for 1908, says:

MEDICATED SOFT DRINKS

Approximately eighty samples of these products have been examined. The investigation was undertaken for the purpose of ascertaining the nature and character of the beverages sold principally at soda fountains, and special attention was given to the detection and estimation of caffeine, cocaine, and coloring matter. A complete analysis has been made in every case, not only to determine the composition of the product, but also to ascertain whether the ingredients claimed to be present were actually used in preparing the drinks. With few exceptions, all contain caffeine added as such. In fact, the caffeine is rarely introduced by using an extract of the plant or article containing the caffeine in natural combination. Cocaine was also found to be present in a large number, and many were artificially colored with coal-tar dyes and agents derived from vegetable and animal sources. The caffeine present in an ounce of medicated soft-drink syrups, the quantity usually entering into a glass of the drink, varied from a trace to 1.2 grains. A considerable number of the medicated soft drinks were free from cocaine; and when its presence was established the amount varied from a trace to 0.05 grain to the ounce, the average amount used in preparing a glass of the beverage. Fifty-four cups of tea and coffee, as served at representative hotels, cafes, and restaurants of Washington, were collected and analyzed for the purpose of ascertaining the quantity of caffeine present and comparing it with the amounts contained in the medicated soft drinks. The average amount of caffeine per cup of coffee was 2.2 grains, varying from 1.55 grains to 3.74 grains. The average content of caffeine per cup of tea was 0.98 grains, varying from 0.31 grains to 2.15 grains. An interesting point brought out is that the tea and coffee served at the better class hotels as a rule contain the greater per cent of caffeine.

Mineral waters.—A mineral water may be misbranded if it is an artificially made water purporting to be a natural water, if it is from a spring geographically remote from the place claiming to be its location, or if the published analysis is vitally incorrect. It is recognized that the quantitative composition of natural mineral waters vary according to season and some other factors. Mineral waters have been condemned and destroyed when they have been bottled under filthy conditions and have become contaminated.

Foods claimed to be medicinal.—“Notice of Judgment No. 3” is an instance of misbranding of flour, the claim being made that it was a gluten flour and devoid of starch. Analysis proved the claim to be false, and it is more than likely that there are other brands of “diabetic flour” not true to label. The New Hampshire Sanitary Bulletin has attacked the “Cresco” flour, “Grape-Nuts,” “Postum Cereal,” Neal’s “Instantaneous Vigor Chocolate Compound,” Neal’s “Dyspepsia Biscuits,” and other so-called “health foods,” and has made out a more or less complete case against them.

Drugs not in interstate trade.—In the absence of specific state legislation, any one can sell within the state most any kind of drug or food he cares to. Most states have some sort of laws, however, hence conditions vary very much over the United States. It appears to be but a question of time until all of the states have good laws enacted.

Denaturing.—The principal substance so treated is alcohol. Different methods are used, but the main point for physicians to know is that denatured alcohol is absolutely unfit for pharmaceutical purposes. The following regulation applies:

(F. I. D. 93)

AMENDMENT TO REGULATION 34

Certain classes of articles are offered for entry into this country which, under certain conditions, are ordinarily used for food purposes. The articles in question are used also for technical purposes. An example of such a product is the nutmeg. The mature and sound nutmeg is used for food purposes, while the defective nutmeg is used for the preparation of nutmeg oil, which has a technical use as an odoriferous principle. The defective nutmeg is not fit for food, but, on the other hand, is as well or even better suited for preparing oil.

Under Regulation 34, as it now stands, shipments of products which are ordinarily used for food, but which in the particular case are intended for use in the arts, must be so denatured as to render them unfit for food purposes, and the invoice accompanying the shipment must declare the technical use. It has proved impracticable to have all such products denatured before they are offered for entry into the United States.

The board of food and drug inspection recommends a change in Regulation 34 of Circular 21 of the office of the secretary, the amended regulation to become effective on the date of issue, and to read as follows:

REGULATION 34, DENATURING

(Section 11)

Unless otherwise declared on the invoice, all substances ordinarily used as food products will be treated as such. Shipments of substances ordinarily used as food products intended for technical purposes should be accompanied by a declaration stating that fact. Such products should be denatured before entry, but denaturing may be allowed under customs supervision, with the consent of the secretary of the treasury, or the secretary of the treasury may release such products without denaturing, under such conditions as may preclude the possibility of their use as food products.

Poisons are subject to regulation by the various states and nearly all of them have laws regulating their sale.

Cold storage modifies the quality of food very materially at times and food depreciated from such reasons is frequently condemned. See the chapter upon Rural Hygiene.

Section II

CONCERNING DRUGS AND FOODS, AND THEIR STANDARDS*

OF no less importance to the public than to the physician, is the necessity of authentic remedial agents, true to name, and of unquestionable quality. Nor is it less essential that foods should be of exceptional authenticity, so far as name, quality, or composition are concerned. The underlying principle regarding each is a statement of fact concerning each. The aim, therefore, of the producer, as well as of the compounder, should be to supply as nearly as possible that which is desired

*By John Uri Lloyd, Phar. M.

by the purchaser, the distributor, and the dealer. For such substances known standards are necessary.

It must not be inferred, however, that a purchaser is restricted to materials thus standardized, or is prevented from using other substances, food or drug, provided he purchases the other materials under a full understanding of their qualities or origin, as obtained from the dealer, who likewise distributes them under a descriptive statement of fact. Nor is experimentation denied whoever desires to investigate in outside directions, or make compounds different from those established by authority. But in these cases distinctive names are necessary in order to avoid confusion with pre-established authoritative compounds. In this connection it should be borne in mind that the distributing of some materials or compounds subject to abuse, to other than qualified or professional authorities, is prohibited by some local statutes, or even by national act, thus preventing the public at large from obtaining materials to which experts only are entitled. Such restrictive laws are formulated for the care of the people, and for the benefit of the public at large, and such supervision by governing bodies has proved to be not only desirable, but exceedingly necessary.

Thus the question of food and drug distribution as well as of standards is complicated in that the right of the man in commerce, the right of the professional man, and the right of the consumer, are alike dominated by different influences and regulations, as well as by distinct ideals concerning the privileges of a free and independent citizen. But the limitations of space prevent us from considering, even cursorily, in this article, the greater number of these problems.

Standards.— It may be accepted that a standard is based upon a statement of fact concerning the substance under consideration. This applies, practically, in every direction where humanity deals with humanity. A purchaser should be given the material he seeks, where this does not conflict with the rights of others; and the producer, the collector, the manufacturer, the manipulator, and the distributor, should, with one mind and act, by a common impulse, serve him in this sense. Thus the commercial standard becomes, in the ultimate analysis, an ethical problem, in which one person aims to deliver to another the material that is desired. This substance may be a natural product, such as milk, or the root or bark of a tree or shrub, such as sassafras or hydrangea, a natural gum or resin, such as acacia or guaiac, a flower, as arnica, a flower bud, as cloves, a leaf bud, as balm of Gilead, or any other outcome of nature's laboratory. Or a compound of well-known substances may be desired, such as the compound cathartic pills, that by manipulative scientific processes, or by the mere act of admixture, possesses distinct attributes that need to be exactly defined. An authoritative body may with this object establish by certain rules and regulations the qualities of a natural product, or the position of a commercial material, this henceforth becoming recognized as the standard form of that substance, and known thus for a period of time under a certain name. The authority for such a standard may be a pharmacopœia made by an authorized body of men, a dispensatory edited by authoritative experts, a *Materia Medica*

written by an individual qualified to speak positively upon the subject, a legal enactment, such as a national, a state, or a city legislative act, an authoritative board, such as a board of health, a dairy commission, a single authoritative individual, as a milk inspector, or an inspector of drugs, or even a manufacturer of a special product peculiar to himself. By legal enactment or by precedent, such authorities as these establish standards that are accepted by the courts, by the people, by the professions, and by the tradesman. The aim of dealers in such materials as have been studied and defined and passed upon by such authorities is to conform to the decisions made in the direction of the qualities of the materials under consideration.

New standards.—As never before are chemists, pharmacists, law-makers, seeking new standards of quality that must, temporarily, be accepted. In this direction, as a stepping stone to possibilities of the future, an individual *constituent* of a natural drug is, as a rule, selected to standardize a total, crude drug product. According to the pharmacopœia, cinchona must contain five per cent cinchona alkaloids, hydrastis must contain two and five tenths per cent hydrastine, and opium must contain not less than nine per cent morphine. It is to be presumed that the forthcoming pharmacopœia will include, aside from the drugs now standardized, a large number of materials that will be thus standardized according to a single, dominating constituent, or, as in cinchona, a number of mixed alkaloids. Such a method, however, is but preliminary to what this writer believes will be the process of the future. It is based, as a rule, *not* upon the intrinsic quality of the texture, in which direction standardization does not as yet often presume to reach, but upon a single dominating factor or class of factors. Such standards as these are now the best possible for the preventing of depravity as concerns selected, single, dominating constituents, but there are other problems that thinking men too well comprehend to be conspicuous factors, in the direction of what is known as *quality* or *excellence*, of which our present method of standardization as a rule takes no cognizance.

Excellence.—The standard of structural excellence is not to be restricted to the amount, more or less, of a single material that may be broken from a drug by the chemist's art. Many problems as yet untouched by most hopeful, earnest, and conscientious standardizers arise before the man who thinks in these directions. For example, the mydriatic alkaloids are not all that contribute to the *excellence* of belladonna root, nor yet do they embrace all that is of worth in belladonna extract, although as yet in them resides the sole recognized standard of belladonna. This fact thoughtful manufacturers who have attempted to make belladonna plasters or other belladonna products by the employment of atropine instead of the natural belladonna extract, too well comprehend. Quinine is not cinchona, nor is morphine opium, and in each case where the alkaloid is employed as a standard of the drug, no account is made of attributes contributing to the *excellence* of that drug, other than is comprehended by the *amount* of the material mentioned. To show the fallacy of this, we need only remark that an apple that is smooth and tempting to look upon may contain its full amount of malic acid, and may yet be insipid to the taste. Wheat may be standardized according to

the amount of starch, gluten, or phosphatic content, and still be musty and unfit for the making of bread. Rye may be free from ergot, and yet unfit for food. Butter and milk of exceptional quality are soon contaminated by the vapor of kerosene, and every housewife knows the importance of keeping her ice chest clean and sweet. A changing flavor, either absorbed from without or created from within, impossible perhaps to be reached by the art of the chemist, or to be defined with mathematical precision, influences foods, drinks, and medicines. Excepting, then, the direct action which in toxic drugs (at present) is usually a shock effect that comes from the one material selected, a standard is not necessarily comprehensive of quality. These are facts well known to all persons concerned in these directions, and the world of chemistry, of pharmacy, of materia medica, and of medicines, is hopefully looking to the evolution that will come under better understanding, greater care, more expensive precautions, increased education, comprehensive experience, fair business methods and ideals, as well as by researches made in lines outside of those that well-meaning and self-sacrificing authority has as yet ventured to touch. Such problems as these are recognized by all involved, and by none more fully than by authorities concerned in standardizing processes.

Varying standards.—The personal equation has naturally much to do with standards such as these, especially as regards manipulative compounds. Prejudice, education, much experience, and *lack of experience as well*, influence every human being. Different viewpoints lead to different conclusions, and thus conflicting standards too often embarrass those dealing in the materials to which the standards are applied. This is well exemplified in the successive revisions of such publications as the pharmacopœia of the United States, in which each decade radical changes are often made, to be superseded, perhaps in the next revision, by something yet more radical, or even by a return to something similar to the former standard. Witness the successive changes in the formula for making citrine ointment, or the descriptive standards of various natural products, changed for this or that reason. In all such cases the standard set by the latest revision of the authoritative publication is *the* authority, whether or not it be approved by either the dealer or consumer. In like manner a standard established by one legislative act may be very different from that fixed by another. And be it remarked, as new standards are adopted, the new one is not necessarily an *improvement* on the old. The new standard may prove in its workings very undesirable, but until it is authoritatively superseded, it is *the standard*, under the authentic name. The physician or the pharmacist desiring a preparation formerly made under authority, but whose formula has now been changed, is debarred the legal use of the name once the official appellation, unless he appends a descriptive note to avoid confusion. For instance it might subject a pharmacist to discipline of the law were he to affix the official name, "Dover's Powder," to a preparation made with potassium sulphate, although not until recently was that substance replaced by sugar of milk. A pharmacist may prepare for a physician desiring that special product, a fluid extract of ipecac by the pharmacopœial process of 1860. but an explanatory statement must show that it is

not the official preparation, as per the most recent pharmacopœial revision.

Natural products.—First in commercial consideration, as well as in professional, are natural products, whether vegetable or animal. These are well defined the world over by authoritative names recognized as applying to individual bodies, whether they be the trees, the shrubs, and the herbs of the botanist; fishes and reptiles, or the animal products of the biologist. It may happen that the *name* applied to a plant or animal product may be changed from that previously used by botanists or pharmacists, as the *chamæ-lirium* of the dispensatory to-day is the *helonias* of former editions, but at all times the *plant*, or other substance under consideration, should be the same and its products should be true to name. The term *podophyllum* should at all times designate the rhizome of a certain plant. These are self-evident facts, and seemingly permit of no discursive argument, but newly arising conditions may necessitate differentiating terms, previously unnecessary.

Differentiating necessities.—Although in former days but one *podophyllum* was known to commerce, two substances now carry that name. One of these, the authoritative, North American *podophyllum peltatum*, has for half a century been a well-known drug, while the other, the more recently introduced East Indian *podophyllum emodi* is just coming into use. The term *podophyllum* may consequently be no longer sufficient to designate the article desired, as the necessity of distinguishing between the two species may become apparent, although both are cathartics and possessed of like action. The digitalis plant produces in its first season an abundant crop of leaves, which are true “Digitalis Leaves,” but only the leaves of the second year’s growth are now *official*. Hence, at present, the leaves of the digitalis must be differentiated, in accordance with its year of growth, although some future standard of authority may not require that this be done. Thus we find exceptions arising to necessitate newly introduced standards of limitation as well as standards of distinction, even though there be no question as to species or origin.

Confusions.—Not only may different drugs be known under a common name, but the same name may be applied to very different plants or parts of plants. For example, *helonias* root in commerce, and *aletris* root in commerce are still very questionable products, although the two are in qualities so distinct, and in appearance so different, as to cause one to wonder how any confusion can exist, either as regards the roots themselves or the products therefrom. The one (*helonias*), is hornlike, with wiry fibers, while the other (*aletris*) about half the size of the first, is knotty, and covered with a mass of wool-like fibers filled with scales, like meal. Both have been called *star-grass*, both have been sold as *aletris*, and both as *helonias*, a confusion that still confounds many earnest workers to such an extent that it is often difficult to determine what should be used under any of the above names. In like manner the various geraniums of commerce are too confused to be differentiated by any published standards. Through no intent to deceive *viburnum prunifolium*, as found in commerce, may be the bark of the black haw, or it may be a species of *cratægus*.

Such are the conditions that arise to plague the men most earnestly

aiming to avoid substitution. Such complications as these lie before all concerned in pharmacy.

Intentional substitution.— Comes now one of the most exasperating of all the problems with which persons concerned in medicinal products have to contend, that of the *intentional* mixing of materials. *Asafetida* may be mixed with sixty per cent, more or less, of sand. Its percentage of ash is thus increased above the pharmacopœial limitations, but this may be corrected by the artful addition of rosin dissolved in turpentine; thus adding other adulterants, as one or the other of these substances is itself debased. *Hydrastis* may contain its weight of the fiber of *caulophyllum*, or the root of *stylophorum diphyllum* may be substituted *in toto*. Belladonna root may be mixed with dandelion root, and dandelion, in turn, may be mixed with chicory. The materia medica is prolific in such substitution, and the care and education of the man seeking for fact and truth to be utilized for the benefit of humanity, are too often balked by the cupidity or dogmatism of the man of ignorance, or of him indifferent to all but wealth. A substance uncertain to begin with not only disturbs the raw material, but leads to a not less uncertain pharmaceutical product thereof.

Causes of adulteration and substitution.— In our opinion these lamentable conditions are due in part to fierceness of competition in business and indifference to true professional, commercial, or altruistic ideals, but mainly to ignorance and greed, money being the chief disturbing element in it all. The problem of obtaining authentic crude materials has, for these reasons, for years increasingly disturbed the professions of pharmacy and of medicine. The examples cited are by no means exceptional. Sophistication and adulteration, even in the face of authoritative regulation, seem more or less to rule the world of commerce, where it is necessary to meet commercial prices of debased essential oils, powdered drugs, crude materials, and other similar substances. Detailed reference in this direction is unnecessary. Too well the conscientious pharmacist and the physician dependent upon him comprehend the extent to which depravity of this nature has prevailed in the drug market of the past, nor is vigilance even now unnecessary, as is exemplified by the following extract from an editorial concerning spirit of turpentine, in *The Oil Paint and Drug Reporter*, November 22, 1909.

With every advance in the value of the genuine, the temptation to adulterate grows stronger, and particularly is this so after a depression in the turpentine industry had kept the price of spirits very low for so long a time.

The big merchant understands, because he watches the markets and makes himself familiar with the terms upon which spirits are sold in Savannah, Jacksonville, and other primary distributing points. The small consumer, however, does not concern himself with such matters. But if he has been in the habit of paying, say, forty cents for his goods, he grows resentful when his jobber suddenly asks him five cents more. He believes, then, that he is being cheated, and he casts about for some other source of supply. Competition for this small scattered trade is, therefore, keen, and some dealers, rather than lose a sale, will not infrequently meet their customers' views as to prices, and their own as to "quality for the money."

Many times, probably in the majority of cases, the consumer is never the wiser

of the fact that the barrel of turpentine he bought and paid for contained five gallons of benzine. In fact, he fondly imagines he made a good bargain, since so many other houses had quoted him a higher figure. In reality he had paid from \$2.25 to \$2.50 more for his barrel of spirits than was necessary. Perhaps the small dealer or consumer calculates himself upon toning down his turpentine, and adds another five or ten gallons of benzine.

Should any one yet imagine that exaggeration in these directions is possible, let him turn to the reports made by the state boards of health to the proceedings of the state and the American pharmaceutical associations, and to the examinations made by chemists and pharmacists generally, as published in current literature and in the proceedings of different societies. Everywhere the lesson is the same, and everywhere the mass of evidence is incontrovertible.

Qualities.— But intentional substitution and adulteration are not alone the cause of depraved materials. A drug may be officially *true to name*, and yet not be a *true standard* of that drug. Quality is a factor, distinct from specific authenticity. Digitalis leaves of the first year's growth, as has been said, are unquestionably digitalis leaves, but they do not, according to the present standard, represent the prime qualities of the plant. Wheat may be valueless as food, by reason of mould or other decomposition factors, and yet be wheat, without any admixture whatever of other substances. Apples may be knotty or wormy, or potatoes sunburnt and acrid, but yet each be positively true to name. The same rule applies to all substances used as food or drugs. Hyoscyamus may be largely destroyed as concerns its therapeutic qualities, but yet be perfectly true, botanically, to name. Peppermint and lavender may have lost their aroma and their excellence, but so far as their *names* are concerned be still peppermint and lavender. Immature podophyllum may be the rhizome of the true may-apple, and yet be practically worthless. Ipecac may be the official drug, but through imperfect curing processes be valueless as a remedy, when contrasted with a standard of excellence. These problems are confronting issues that wedge themselves not less conspicuously into the field of this discussion, and are even more difficult to meet than are those of commercial substitution and sophistication.

Pharmaceutical preparations.— Important as are the aforementioned subjects to persons concerned in handling crude materials, they become more important to the manipulator of pharmaceutical preparations. Adulterations not only lessen values when materials are given in substance, but they create sad havoc in unseen directions in pharmaceutical methods and products, where the influence of foreign materials exerts itself in unexpected directions upon menstrua adapted to other standards, or upon the component parts of the drugs themselves. For example, the mixing of geranium with hydrastis adds a new, astringent quality, so different from that of hydrastis alone, as to disturb the action of a menstruum employed in producing a delicately formulated preparation of hydrastis. To dissolve common rosin in turpentine and mix this with asafetida not only disturbs the product sold under the name asafetida, but brings to the pharmacist who attempt to make "Milk of Asafetida" by pharmacopœial processes a problem that did not

arise in the manipulative experience of the man who with true *asafetida* established the formula. The introduction of petroleum products through the spirits of turpentine adds another factor which not only disturbs the manipulative work of the pharmacist, but confounds the physician using the product, who might perhaps not object to the spirits of turpentine, but who does not desire to medicate his patient with benzine. It is not therefore in the direction of the crude standards alone that an adulteration accomplishes harm, but also in the untoward influences exerted by adulterations in outside lines, displacing the materials they are used to cheapen, or adding unknowns to disturb manipulative processes or therapeutic action. A mighty problem, then, is sophistication in pharmacy, a problem apparent only to the pharmacist comprehending the outreaches of all that comes from a combination of all these commercial methods.

Growth of the evil.—Decade after decade the problems of sophistication and adulteration and the necessity of standards grew as does a noxious plant, or the fungus of the night. In the absence of any legal penalties of consequence, and under the influence of the well-known adage, "Just as good and cheaper," the sophisticators, competing for the cent, multiplied exceedingly, entrapping the unwary and confounding even the expert. Medical and pharmaceutical print in helplessness teemed with exposures of wrong, intentional and otherwise. Papers read before pharmaceutical and medical associations presented the alarming conditions increasingly, but yet ineffectually, year after year. Improvements in chemical examination processes enabled professional chemists to test more accurately the materials distributed throughout the country, and their unavailing protests arose in a mighty cry. The problem became no longer a threatening specter, but a dominating factor that must be reckoned with in life and in business. A mighty cry went up for relief which was voiced alike by handlers, by physicians and pharmacists and by consumers, all helpless in the grasp of a mighty evil. The Committee of Revision of the Pharmacopœia of the United States in 1880 and 1881, under the talented leadership of Dr. Charles Rice, had broadened the scope of this work in the direction of standardizing its products, and under Professor Remington (1900), the movement advanced onward and upward, with mighty strides. State boards of health, of pharmacy, and of medicine at last turned their attention to the *regulation* of food and drug products. The literary magazines of the country and the daily press became aware of the stupendous wrong being committed upon a helpless people, and took part in the crusade. The President of the United States awoke to the emergency. Finally, Congress felt the touch of that which needed no interpreter. The issue was met in the recent law, designed both to protect the people and to regulate the evil of adulteration and sophistication.

Results.—The National Pure Food and Drug Law, which now, under the leadership of Dr. H. W. Wiley, is being so admirably enforced wherever it is possible, by the Agricultural Department, has accomplished a world of good, and bids fair so to continue, if the work is not interrupted. The state boards are severally uniting their efforts for reform, and in some directions where the hands of the national authorities seem to be tied, state authori-

ties are preventing many wrongs that otherwise might occur. The revolution in these directions came unexpectedly, but even in the short period that has elapsed a mighty work has been accomplished.

Recapitulation.— The subject of adulteration and sophistication has been one of evolution, in which in the absence of official regulation, until a very recent date, too little care has been given to the problem of adulteration necessitated in order to satisfy greed, to meet competition, or to escape thoughtful exertion. Ignorance, cupidity, indifference, dogmatic intolerance on the part of those unqualified or inexperienced thus prevailed, increasingly, until at last nearly every substance that might be mentioned as a food or a drug when not under a reputable label of a responsible firm was liable to be contaminated or depraved. The most careful were not capable of self-protection. Pharmaceutical preparations, even where the utmost care was taken, might be distinctly different as prepared by earnest, honest men, in different localities, but by the same processes, or even when at different periods they were made by the same man of materials of different qualities of excellence. Came at last the mighty rebellion that, as has been said, resulted in the government's taking charge of the interstate commerce, and in the respective state and city boards charging themselves with the responsibility of the individual states' commerce. Now, the medical and the pharmaceutical professions under improved systems of education, and a better understanding of commercial conditions, are taking better care of the present, and are looking more hopefully to the future. But in all these directions there is yet much to accomplish.

Section III

PURE DRUGS AND FOODS

FOOD STANDARDS

(1) Animal products, (2) Vegetable products, (3) Preservatives and coloring matters, Final remarks.

JUNE 26, 1906, a federal proclamation was issued defining certain revised standards of purity for food products. Certain schedules were not issued because not yet perfected. The general basis was that normal to pure foods of American production. Many of the states have adopted these standards and some have added to them, notably Louisiana. It would not be of very general interest to simply reproduce the "food standards" without comment. Hence, we will detail the United States standards with comments derived from various sources. The standards will appear in small type.

For data used I am indebted to the publications of the federal departments, the state boards of many states, to "Food and Dietetics," by Hutchison, and to many articles in medical and other current periodicals. The

effort is made to avoid anything at all questionable and to supply only well-verified data.

I. ANIMAL PRODUCTS

A. MEATS AND THE PRINCIPAL MEAT PRODUCTS

a. *Meats*

1. *Meat flesh* is any clean, sound, dressed, and properly prepared edible part of animals in good health at the time of slaughter, and if it bears a name descriptive of its kind, composition, or origin, it corresponds thereto. The term "animals," as herein used, includes not only mammals, but fish, fowl, crustaceans, mollusks, and all other animals used as food.

2. *Fresh meat* is meat from animals recently slaughtered and properly cooled until delivered to the consumer.

3. *Cold storage meat* is meat from animals recently slaughtered and preserved by refrigeration until delivered to the consumer

4. *Salted, pickled, and smoked meats* are unmixed meats preserved by salt, sugar, vinegar, spices, or smoke, singly or in combination, whether in bulk or in suitable containers.

Government meat inspection is referred to in the earlier section of this chapter and in the chapter upon Rural Hygiene. Also see the chapter upon Local Boards of Health, in which the local regulations proper to the care and inspection of meat are touched upon under the special problems of cities. Practical details are found in the Rural Hygiene chapter, and cold storage is there discussed as well. Some states do not permit the sale of horse meat. Congress has authorized a study of cold-storage methods and the proper length of time for meats to remain in cold storage. Some states have regulations upon the matter, the legal limit of time being as low as twenty-four hours for milk and fish, and three weeks for meats. The Massachusetts Board conducted elaborate experiments upon poultry kept in cold storage and their conclusions are given in our chapter upon Rural Hygiene (q. v.). In France and in the more northern countries of Europe, frozen meats and horse flesh are largely used. From personal trial I can see no harm from either custom. It is asserted that freezing meat does not reduce its nutritive value, but some authorities do not favor the practice of freezing fish. The question of tuberculous meat is discussed elsewhere in this book (Chapter VIII and the Appendix). Outside of meats in interstate commerce, the question of keeping meats up to standard is largely one for local regulation and inspection.

It is illegal to paint a preservative over meat and call it "smoked," as has been done, the mixture being some solution of creosote. Do not let any one impose such a dangerous process upon you. The substance is more or less toxic, and it does not penetrate sufficiently to prevent decay in the deeper portions. It is truly "embalmed beef." Possibly there is justification in dipping cured meats into a solution of sodium benzoate to prevent the formation of mould upon the surface. Meats should not be placed into "pickle" or brine heated to a degree sufficient to coagulate the

surface and prevent the free transfusion of the solution. Shellfish generally decompose very readily, and are apt to produce ptomaine poisoning. Oysters are well known to harbor typhoid bacilli if their beds are polluted with sewage containing the dejecta of typhoid patients. The fresh water oysters marketed early in the fall are the more liable to be so infected.

b. Manufactured Meats

1. *Manufactured meats* are meats not included in paragraphs 2, 3, and 4, whether simple or mixed, whole or comminuted, in bulk or in suitable containers,* with or without the addition of salt, sugar, vinegar, spices, smoke, oils, or rendered fat. If they bear names descriptive of kind, composition, or origin, they correspond thereto, and when bearing such descriptive names, if force or flavoring meats are used, the kind and quantity thereof are made known.

The quality of this class of products has so markedly improved within the last two years that it would be unfair to print the findings of analysts published two years ago. That they *were* distinctly bad does not admit of doubt, but at present the public can feel safe in purchasing such wares packed by any reputable house.

Any meat-food product bearing the legend "United States Inspected and Passed" may contain no preservatives except salt, sugar, vinegar, spices, wood smoke, and saltpeter. Some packers claimed that their goods would not keep, but they were mistaken, for they *do* keep. Packers who are not influenced by interstate regulations and who do business in states not provided with adequate laws, adulterate with borax and sulphur dioxide as a rule. Aniline dye, salicylic acid, and "preservative" are sometimes used. Prime meat chopped fine and placed in a refrigerator at fifty degrees will keep fresh for fifty hours or more, despite what some butchers may say. Frankfurters, bologna, pork sausage, hamburger steak, etc., may be well salted, spiced, and peppered, and will keep for three days in a refrigerator. Tinned meats can be well sterilized, and there is no excuse for the addition of a preservative beyond the simple and natural ones allowed. Mince meat is open to the air and is difficult of preservation unless containing considerable brandy and spice. After clams are canned, they may develop a little sulphuretted hydro-

*Suitable containers for keeping moist food products, such as syrups, honey, condensed milk, soups, meat extracts, meats, manufactured meats, and undried fruit and vegetables, and wrappers in contact with food products, contain on their surfaces, in contact with the food product, no lead, antimony, arsenic, zinc, or copper, or any compounds thereof or any other poisonous or injurious substance. If the containers are made of tin plate they are outside soldered, and the plate in no place contains less than one hundred and thirteen (113) milligrams of tin on a piece five (5) centimeters square or one and eight tenths (1.8) grains on a piece two (2) inches square.

The inner coating of the containers is free from pinholes, blisters, and cracks.

If the tin plate is lacquered, the lacquer completely covers the tinned surface within the container and yields to the contents of the container no lead, antimony, arsenic, zinc, or copper or any compounds thereof, or any other poisonous or injurious substance.

gen and blacken the inside of the can, but that is not dangerous. Only clean grown and well-selected clams should be canned. There are inferior species of salmon sometimes canned under fanciful names, and the department has ruled that when humpback and dog salmon are canned they must be so labelled. Also that lake herring and cisco must not be branded as white fish. Louisiana defines standards for meat extracts, meat peptones, meat juice, and gelatine. In view of the fact that gelatine is usually made under filthy surroundings, it needs to be regulated. Many sardines are packed in cotton-seed oil instead of olive oil. That is misbranding when the goods are claimed to be packed in olive oil. Cotton-seed oil is perfectly healthful, however.

c. Lard

1. *Lard* is the rendered fresh fat from hogs in good health at the time of slaughter, is clean, free from rancidity, and contains, necessarily, incorporated in the process of rendering, not more than one (1) per cent of substances other than fatty acids and fat.

2. *Leaf lard* is lard rendered at moderately high temperatures from the internal fat of the abdomen of the hog, excluding that inherent to the intestines, and has an iodine number not greater than sixty (60).

3. *Neutral lard* is lard rendered at low temperatures.

It is not thought that lard is largely adulterated. Sometimes it is beaten up with water to make it appear very white, but this is readily detected. A few years ago, substitutes for lard, composed of tallow and cotton-seed oil, were upon the market, but they never came into very general use.

B. MILK AND ITS PRODUCTS

a. Milks

1. *Milk* is the fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within fifteen days before and ten days after calving, and contains not less than three and one half (3.5) per cent of fat, and not less than thirteen (13) per cent of milk solids, except in the months of April, May, June, July, August, and September, when it must contain not less than three (3) per cent of fat and not less than twelve (12) per cent of milk solids. Milk produced by cows fed upon the refuse of breweries or distilleries cannot be sold.

2. *Blended milk* is milk modified in its composition so as to have a definite and stated percentage of one or more of its constituents.

3. *Skim milk* is milk from which a part or all of the cream has been removed, and contains not less than nine and one quarter (9.25) per cent of milk solids.

4. *Pasteurized milk* is milk that has been heated below boiling, but sufficiently to kill most of the active organisms present, and immediately cooled to fifty degrees Fahrenheit or lower.

5. *Sterilized milk* is milk that has been heated at the temperature of boiling water or higher for a length of time sufficient to kill all organisms present.

6. *Condensed milk, evaporated milk*, is milk from which a considerable portion

of water has been evaporated, and contains not less than twenty-eight (28) per cent of milk solids, of which not less than twenty-seven and five tenths (27.5) per cent is milk fat.

7. *Sweetened condensed milk** is milk from which a considerable portion of water has been evaporated, and to which sugar (sucrose) has been added, and contains not less than twenty-eight (28) per cent of milk solids, of which not less than twenty-seven and five tenths (27.5) per cent is milk fat.

8. *Condensed skim milk* is skim milk from which a considerable portion of water has been evaporated.

9. *Buttermilk* is the product that remains when butter is removed from milk or cream in the process of churning.

10. *Goat's milk, ewe's milk, et cetera*, are the fresh, clean, lacteal secretions, free from colostrum, obtained by the complete milking of healthy animals other than cows, properly fed and kept, and conform in name to the species of animals from which they are obtained.

The whole question of milk has been discussed in the chapter upon Rural Hygiene, and need be but touched upon here. With regard to condensed milk some of the manufacturers claim that they cannot profitably conform to the federal standards. Malted milk has no standard laid down for it. Cream must contain eighteen per cent of milk fat.

c. Milk Fat or Butter Fat

1. *Milk fat, butter fat* is the fat of milk and has a Reichert-Meissl number not less than twenty-four (24) and a specific gravity not less than 0.905 $\left(\frac{100^{\circ}\text{C.}}{40^{\circ}\text{C.}}\right)$

d. Butter

1. *Butter* is the clean, non-rancid product made by gathering in any manner the fat of fresh or ripened milk or cream into a mass, which also contains a small portion of the other milk constituents, with or without salt, and contains not less than eighty-two and five tenths (82.5) per cent of milk fat. By acts of Congress approved August 2, 1886, and May 9, 1902, butter may also contain added coloring matter.

2. *Renovated butter, process butter*, is the product made by melting butter and reworking, without the addition or use of chemicals or any substances except milk, cream, or salt, and contains not more than sixteen (16) per cent of water and at least eighty-two and five tenths (82.5) per cent of milk fat.

*The Joint Committee on Food Standards of the Association of Official Agricultural Chemists, and the Association of State and National Food and Dairy Departments, recommend that the suggested changes in condensed milk standard be left open for future consideration, pending further investigation, and that the secretary of agriculture be requested not to enforce the present standard in respect to total solids in cases where the solids are below twenty-eight per cent; and, further, that, pending investigations, the various state authorities, do not enforce the aforesaid standard with respect to total solids where the milk fat found in condensed milk is not less than seven and seven tenths per cent.

e. *Cheese*

1. *Cheese* is the sound, solid, and ripened product made from milk or cream by coagulating the casein thereof with rennet or lactic acid, with or without the addition of ripening ferments and seasoning, and contains, in the water-free substance, not less than fifty (50) per cent of milk fat. By act of Congress, approved June 6, 1896, cheese may also contain added coloring matter.

2. *Skim milk cheese* is the sound, solid, and ripened product, made from skim milk by coagulating the casein thereof with rennet or lactic acid, with or without the addition of ripening ferments and seasoning.

3. *Goat's milk cheese, ewe's milk cheese, et cetera*, are the sound, ripened products made from the milks of the animals specified, by coagulating the casein thereof with rennet or lactic acid, with or without the addition of ripening ferments and seasoning.

Butter is pretty fully discussed in Chapter VIII and to which readers are referred. The creameries make the best butter, and it keeps longer than does country butter, because it is worked better and contains less free milk. However, I would like to see some of the food experts live upon the farm for a while and learn a few things they need to learn. This thing of setting up arbitrary standards for butter and milk is just about as sensible as setting up a standard for the number of knots in a pine log. Despite all theory, milk does vary immensely and many an innocent man has been fined for selling milk that was below the legal standard, but that was sold as pure as it came from the cow. Milk is the article of which we rob the calf and the process of keeping up the supply is artificial. Some cattle respond well to the artificial stimulus and some do not. Some give rich milk and some give poor; it ever was thus, and it ever will be, despite all the laws ever made. With all of the requirements of to-day, it hardly pays a farmer to make butter, unless he can sell at fancy prices direct to the consumer. I have found it pays best, in the long run, to sell to the creamery. With their machinery, they can make a uniform product up to legal requirements. As to renovating butter, half the butter sold would be better for renovation. The facts are, the speculators buy up the butter and hold it for higher prices, and then the farmer gets the blame for making bad butter. It is either packed or renovated before the consumer ever sees it, half of the time. I would rather eat good oleomargarine than the packed butter so commonly sold. Oleomargarine is a wholesome and tasteful product and, expressing my personal opinion only, I believe it will only be a question of a few years until it is allowed to be colored and sold freely as *imitation* butter, and also only a few years until it will be a misdemeanor to palm off packed butter upon the public.

Cheese is discussed in Chapter VIII. The quality of this food has very markedly improved in this country. The writer remembers how the creameries used to handle cheese, but that day is no more, and it is probably true, as claimed, that creameries are the most sanitary of food-producing establishments to-day. However, a few creameries resort to soaking the curd in cold water to give a softer mixture and to increase the weight by the addition of water. This process is contrary to regulations.

f. Ice Cream

Ice cream is a frozen product containing not less than eight per cent of butter fat and eighteen per cent of milk solids, with the addition of sugar (sucrose) and with or without natural flavoring, and not to exceed seven tenths of one per cent of gelatine.

Fruits, nuts, candied and preserved fruits and nuts, chocolate and other similar products shall be classed as flavorings, and ice cream containing such ingredients shall conform to the standard above specified.

g. Miscellaneous Milk Products

1. *Whey* is the product remaining after the removal of fat and casein from milk in the process of cheese making.

2. *Kumiss* is the product made by the alcoholic fermentation of mare's or cow's milk.

The standard printed above for ice cream is that of Indiana. That of the federal department is as follows:

f. Ice Creams

1. *Ice cream* is a frozen product made from cream and sugar, with or without a natural flavoring, and contains not less than fourteen (14) per cent of milk fat.

2. *Fruit ice cream* is a frozen product made from cream, sugar, and sound, clean, mature fruits, and contains not less than twelve (12) per cent of milk fat.

3. *Nut ice cream* is a frozen product made from cream, sugar, and sound, non-rancid nuts, and contains not less than twelve (12) per cent of milk fat.

In "Hygienic Laboratory Bulletin, No. 41," Dr. Wiley has a long article upon ice cream in the District of Columbia. In his conclusions, he urges better sanitary surroundings in ice cream factories, the federal standard for butter fat is upheld, the need for thickeners is denied, the use of condensed milk or cream in manufacture is condemned, and the storage and shipping of ice cream is not looked upon with favor.

Personally I doubt if Dr. Wiley can sustain his position, and I believe the Indiana regulations are to be preferred to the federal ones, so far as ice cream is concerned. From personal consumption of the product as sold in many places in the District of Columbia, it impresses me that much of their ice cream does not contain fourteen per cent of milk fat. As a matter of fact, taste differs in that regard, and thousands of people do not like so fatty an ice cream. I authorize its use by sick persons under my care and would prefer that what they eat contain not over ten per cent of milk fat. From analyses made all over the United States I note that the greater proportion of ice cream contains less fat than fourteen per cent.

As will be noted, Indiana allows a small amount of gelatine. The California Board states: "From a hygienic standpoint there is no objection whatever to the addition of a small amount of gelatine to ice cream; but when such additions are made, the fact must be stated on the label in order

to conform to the provisions of the law. Similarly with respect to the addition of allowable coloring matter to ice cream."

In New Hampshire fourteen per cent of butter fat is required, but eggs may be added. Of one hundred and four samples examined, sixty-six and two tenths per cent failed to conform to requirements. This board admits that gelatine, gum tragacanth, or agar-agar is commercially necessary to make ice cream "stand up," and they hold that just how long ice cream may be stored without becoming insanitary has not yet been determined. In consequence, the board is not pushing the matter against technical offenders.

I have looked into this matter in detail. Undoubtedly it is true that immense quantities of ice cream is being made in filthy surroundings and the reputable dealers deplore this fact. I find the large makers doing all they can to provide a good and sanitary article. They tell me it is easy enough to make a cream up to federal standards, but that it cannot be sold cheap, and that there is a large demand for a cheaper but sanitary cream. Nearly all of them must make it to sell on Sunday and the orders are filled on Saturday and many of them have a large drug store trade where the cans are frequently opened. To carry this trade, gelatine is absolutely necessary, as such ice cream must be well iced and it breaks down in the middle of the can and freezes to the sides of the cans unless gelatine is used. They have calls for frozen custard and must use eggs and a trace of brandy in that or take it off the list. Storing the cream even for a few hours bleaches out the color of strawberry, pistachio nut, etc., and some artificial coloring matter is required to meet the requirements of their trade.

It must not be forgotten that ice cream is one of the luxuries of the poor in our cities. They crave something cold and cheap, and it impresses me that so long as it is clean and healthful, it is no function of the state to say that only one grade of ice cream must be made and that grade so high in price as to deny its use to the poor.

II. VEGETABLE PRODUCTS

A. GRAIN PRODUCTS

a. *Grains and Meals*

1. *Grain* is the fully matured, clean, sound, air-dry seed of wheat, maize, rice, oats, rye, buckwheat, barley, sorghum, millet, or spelt.

2. *Meal* is the clean, sound product made by grinding grain.

3. *Flour* is the fine, clean, sound product made by bolting wheat meal and contains not more than thirteen and one half (13.5) per cent of moisture, not less than one and twenty-five hundredths (1.25) per cent of nitrogen, not more than one (1) per cent of ash, and not more than fifty hundredths (0.50) per cent of fiber.

4. *Graham flour* is unbolted wheat meal.

5. *Gluten flour* is the clean, sound product made from flour by the removal of starch, and contains not less than five and six tenths (5.6) per cent of nitrogen and not more than ten (10) per cent of moisture.

6. *Maize meal, corn meal, Indian corn meal* is meal made from sound maize grain and contains not more than fourteen (14) per cent of moisture, not less than one and twelve hundredths (1.12) per cent of nitrogen, and not more than one and six tenths (1.6) per cent of ash.

7. *Rice* is the hulled, or hulled and polished grain of *oryza sativa*.

8. *Oatmeal* is meal made from hulled oats, and contains not more than twelve (12) per cent of moisture, not more than one and five tenths (1.5) per cent of crude fiber, not less than two and twenty-four hundredths (2.24) per cent of nitrogen and not more than two and two tenths (2.2) per cent of ash.

9. *Rye flour* is the fine, clean, sound product made by bolting rye meal, and contains not more than thirteen and one half (13.5) per cent of moisture, not less than one and thirty-six hundredths (1.36) per cent of nitrogen, and not more than one and twenty-five hundredths (1.25) per cent ash.

10. *Buckwheat flour* is bolted buckwheat meal, and contains not more than twelve (12) per cent of moisture, not less than one and twenty-eight hundredths (1.28) per cent of nitrogen, and not more than one and seventy-five hundredths (1.75) per cent of ash.

After June 9, 1909, bleached flour is illegal, according to decision 100. It has been extensively bleached by using nitrogen peroxide. The weight of authority is all against this or any other bleaching process. It is frequently the case that flour is misbranded. For instance, when flour is labelled "Flour manufactured from Finest Hard Spring Wheat," and durum wheat is mixed with it, or when flour is labelled "Paragon Minnesota Cream Roller Process," when it is ground in Ohio of Ohio winter wheat; such flours are misbranded and the matter is of importance to bakers, because they sell variously named breads made of flours mixed by themselves, and it is important that they be able to maintain a uniform product. The large bakers maintain that a mixed flour makes a better bread.

Wheat grown in the northwest usually contains more gluten than does eastern grown grain. The California Board has studied this matter and finds a variation in total protein ranging from six and six one-hundredths per cent to nine and seventy-one hundredths per cent in wheat flour. It impresses me that malted grains might well be more fully looked after by the food experts and grain is often poorly cared for. If you want that fact well emphasized, visit the factory at Niagara Falls, where shredded wheat biscuit is made. They will tell you of the great trouble and expense to which they are put to secure good and *clean* wheat for their products. Visit a grain elevator and note the cockle and jimson weed seed and the rat dung that is mixed with wheat. Suppose some of those rats had bubonic plague? I know from seeing it with my own eyes in country mills, that such wheat is often ground up into flour, weed seeds, dung, and all. Comment is unnecessary. Food Inspection, Decision 90, does not allow that sort of thing for *stock and poultry*. I have seen decomposed corn nubbins ground up, cobs and all, to mix into "feed," and the bad odor is concealed by adding a little copperas. The small mills in this country are seriously in need of being regularly inspected. Pellagra results from using bad corn.

Graham flour is classed as "unbolted wheat meal," and sometimes that is commercially true. More frequently, it comes from the small and

old-fashioned mills and is composed of "middlings" mixed with bran. The product is healthy and "middlings" make a really good bread. It impresses me that if "first middlings" from the burr mills were sold, the product would have a good sale for human food, and it would be more honorable than mixing it with other meals. Middlings make excellent griddle cakes. Gluten flour is often misbranded. See the "New Hampshire Bulletin." Probably as good gluten flour as one could get would be to remove the bran from what won't go through the bolting cloth in a roller process mill. White flour is deficient in gluten.

Corn meal is sometimes made of damaged corn, and in the south pellagra is often so produced. The German people in Pennsylvania oven-dry much of their corn before it is ground into meal, and it impresses me as good practice. F. I. D. 67 bears upon an important matter and is here reproduced:

POLISHING AND COATING RICE

It has been represented to the department that it is a very common practice in this country in the preparation of rice for commerce to treat it in the following manner:

1. The rough rice is passed through a set of stones, or shellers, which removes the hull.
2. The product is subjected to a series of scouring machines by which the bran and cuticle are removed.
3. The rice is passed through a machine that is known as the brush, which removes a portion of the flour, or more commonly known as polish.
4. The rice is introduced into a warm revolving drum or cylinder holding often as much as four thousand pounds, and glucose and talc are added in the following manner, and in about the following proportion: As the rice is fed into the drums a small proportion of glucose and talc are applied, namely, glucose one one-thousandth and talc one three-thousandth part of the whole. The object of the glucose is to form a coating by means of which a part of the talc is held on the surface of the rice.

It is stated that the rice is coated for the following reasons:

1. The coating makes the rice less susceptible to dust and other foreign matter during transportation and storage.
2. It is, in a measure, a preventive against the attack of the weevils and worms which are so destructive in warm climates.

It has also been represented that in some instances paraffin is used instead of glucose, and that rice starch is sometimes used in place of talc for the purpose of finishing rice according to the method described above.

In submitting these representations it has been asked if the process above described is permitted under the food and drugs act of June 30, 1906. It is not clear to the department that coating rice in this way protects it in any manner from dust. Evidence of an expert character is also on file in the department, showing that unpolished rice is no more subject to the ravages of the weevil than the polished article.

It is the opinion of the department that no coating of any kind can be used in the manner indicated if the product "be mixed, colored, powdered, coated, or stained in a manner whereby damage or inferiority is concealed." In each case whether or not such a result be secured is a question of fact to be decided by the evidence.

It is held by the department that rice treated in the manner indicated above with glucose and starch should be labeled in all cases with the name of the extraneous substances, as

“ COATED WITH GLUCOSE AND STARCH ”

In such declarations all of the food substances used for coating should be mentioned. Any coloring matter or other substances that may be employed to change the tint of the rice should be declared on the label.

The question of the wholesomeness of paraffin, talc, or other non-food substances used is to be construed in such a way as to protect the health of those most susceptible to their influences. Rice is a diet often prescribed for those suffering from impaired digestion. The use of paraffin in such cases is at least of questionable propriety, and in the opinion of the department it should be excluded from food products. Under the fifth provision of foods, section 7 of the food and drugs act, June 30, 1906, and under Regulation 14, the use of talc is permitted, provided that each package be plainly labeled with the name of this preservative and the proper directions for removal be given.

This illustrates a very foolish American prejudice. In Japan the outer glutinous coating of the rice grain is not thrown away, as is done here. We wonder why the Japanese thrive so well upon rice. If we used the grain in the rational way of Japan, we too would thrive upon this food so much superior to oatmeal. As it is, we reject all of the grain except the starch and then consider cooked rice “ nothing with something on it.” American grown rice is of high quality and should become a valuable American asset if our people only learned how to prepare the grain for food.

Buckwheat flour is commonly adulterated. Half of the residents of the United States who eat buckwheat cakes have never tasted cakes made of pure buckwheat, and if they did taste them, would not like them. It is commonly simply mixed with other meal or ground beans and, so long as the label states the facts, there is no sanitary reasons to be urged against the admixture. Pure buckwheat meal makes a heavy cake, not very readily digested.

The numerous cereal foods upon the market are not subject to criticism upon a sanitary basis, but they are very high priced in view of their limited food value in proportion thereto. The Pennsylvania Dairy and Food Department at Harrisburg issued a bulletin upon the subject that is well worth reading, and they brought suits against the manufacturers of “Grape-Nuts ” and “ Postum Cereal ” upon the basis of misbranding. This suit resulted in some labels being changed, but in general the claims of these manufacturers for their goods go away beyond the actual facts in the case.

B. FRUIT AND VEGETABLES

a. *Fruit and Fruit Products*

(Except fruit juices, fresh, sweet, and fermented, and vinegars.)

1. *Fruits* are the clean, sound, edible, fleshy fructifications of plants, distinguished by their sweet, acid, and ethereal flavors.

2. *Dried fruit* is the clean, sound product made by drying mature, properly prepared, fresh fruit, in such a way as to take up no harmful substance, and conforms

in name to the fruit used in its preparation; *sun-dried fruit* is dried fruit made by drying without the use of artificial means; *evaporated fruit* is dried fruit made by drying with the use of artificial means.

3. *Evaporated apples* are evaporated fruit made from peeled and cored apples, and contain not more than twenty-seven (27) per cent of moisture determined by the usual commercial method of drying for four (4) hours at the temperature of boiling water.

(Standards for other dried fruits in are preparation.)

4. *Canned fruit* is the sound product made by sterilizing clean, sound, properly matured and prepared fresh fruit, by heating, with or without sugar (sucrose) and spices, and keeping in suitable, clean, hermetically sealed containers, and conforms in name to the fruit used in its preparation.

5. *Preserve* is the sound product made from clean, sound, properly matured, and prepared fresh fruit and sugar (sucrose) syrup, with or without spices or vinegar, and conforms in name to that of the fruit used, and in its preparation not less than forty-five (45) pounds of fruit are used to each fifty-five (55) pounds of sugar.

6. *Honey preserve* is preserve in which honey is used in place of sugar (sucrose) syrup.

7. *Glucose preserve* is preserve in which a glucose product is used in place of sugar (sucrose) syrup.

8. *Jam, marmalade*, is the sound product made from clean, sound, properly matured and prepared fresh fruit and sugar (sucrose), with or without spices or vinegar, by boiling to a pulpy or semi-solid consistence, and conforms in name to the fruit used, and in its preparation not less than forty-five (45) pounds of fruit are used to each fifty-five (55) pounds of sugar.

9. *Glucose jam, glucose marmalade*, is jam in which a glucose product is used in place of sugar (sucrose).

10. *Fruit butter* is the sound product made from fruit juice and clean, sound, properly matured and prepared fruit, evaporated to a semi-solid mass of homogeneous consistence, with or without the addition of sugar and spices or vinegar, and conforms in name to the fruit used in its preparation.

11. *Glucose fruit butter* is fruit butter in which a glucose product is used in place of sugar (sucrose).

12. *Jelly* is the sound, semi-solid, gelatinous product made by boiling clean, sound, properly matured, and prepared fresh fruit with water, concentrating the expressed and strained juice, to which sugar (sucrose) is added, and conforms in name to the fruit used in its preparation.

13. *Glucose jelly* is jelly in which a glucose product is used in place of sugar (sucrose).

As will be observed, the question raised in this schedule is that of glucose. Sucrose is sugar of the disaccharid order and includes that made from cane, beets, maple, malt, and milk. Glucose is a monosaccharid and includes grape sugar or dextrose, fruit sugar or levulose, and invert sugar of which honey is an example. Commonly invert sugar is a mixture of dextrose and levulose. If cane sugar is boiled with acid it is inverted and becomes less sweet and will not crystallize. In making jams, jellies, preserves, etc., the cane sugar is inverted to a large degree and not only develops the flavor of the fruit, but also becomes more digestible. The long boiling of homemade jellies, etc., is what makes them agree better with the stomach than do the

commercial products. In commercial practice, it is a temptation to boil the fruit first and add the sugar last, because less sugar will make the product taste as sweet. Preserves made in that way are apt to ferment in the stomach.

Hutchison says: "Commercial glucose, on account of its incapability of crystallizing, is often used to make jam from inferior fruit or from the remains of fruit, the juice of which has been used to make fruit syrups and jellies. Such jam may have a good appearance, but is deficient in fruit flavor. It is, however, quite wholesome and nutritious."

I feel entirely justified in saying that the home process of making jams, jellies, preserves, etc., results in a better product than in that of any factory. Before writing this book, I did a lot of detective work, and what I say comes from first-hand information. The better class of factories really do make a product of which the United States can be proud. They have large farms and raise choice fruit and materials for pickles and they are clean in their processes and use cane sugar. They show every evidence of wishing to conform to the law. Nevertheless, they cannot quite reach the home standard. But for all that, the pulp is not wasted. There are more than the regular brands and they are "made for" such and such firms who sell them to the cheap trade and to the "dagoes." This glucose stuff is all healthy. It is not high class, but it is clean, well-made, sanitary, and truly labelled and tastes pretty fair. It is just what it claims to be when it leaves the factory.

There is a vast deal of hue and cry against glucose that is just as unfair as is that against oleomargarine or margarine, as it should be called. Both products are cleaner than are the products they are endeavoring to displace. Both are healthy and nutritious. The only real points against glucose are those noted under "Glucose Products," and especially that the sulphuric acid used in manufacture is not fully eliminated from the finished product. That is true enough and it is a bad point when it comes to molasses and beer, which are used to excess. It is not so bad a point in jams and jellies. So far as it relates to the latter, it is simply supplying the poor a second grade, but healthy product and that is far better than none and that comes within the reach of their purses. As to evaporated fruit, I ran an evaporator long enough to learn that the momentary touch of sulphur fumes the fruit gets will do the consumer no harm, and I wish I had a photograph showing one of the many bad conditions under which I have seen fruit dried in the country.

There have been several "Notices of Judgment" as to canned fruit. Underweight, faulty labeling as to point of manufacture, and other matters not involving the sanitary character of the products were the points at issue in most of the cases.

B. VEGETABLES AND VEGETABLE PRODUCTS

1. *Vegetables* are the succulent, clean, sound, edible parts of herbaceous plants used for culinary purposes.

2. *Dried vegetables* are the clean, sound products made by drying properly matured and prepared vegetables in such a way as to take up no harmful substance and conform in name to the vegetables used in their preparation; *sun-dried vegetables*

are dried vegetables made by drying without the use of artificial means; *evaporated vegetables* are dried vegetables made by drying with the use of artificial means.

3. *Canned vegetables* are sound, properly matured, and prepared fresh vegetables, with or without salt, sterilized by heat, with or without previous cooking in vessels from which they take up no metallic substance, kept in suitable, clean, hermetically sealed containers, are sound and conform in name to the vegetables used in their preparation.

4. *Pickles* are clean, sound, immature cucumbers, properly prepared, without taking up any metallic compound other than salt, and preserved in any kind of vinegar, with or without spices; *pickled onions*, *pickled beets*, *pickled beans*, and other pickled vegetables are vegetables prepared as described above, and conform in name to the vegetables used.

5. *Salt pickles* are clean, sound, immature cucumbers, preserved in a solution of common salt, with or without spices.

6. *Sweet pickles* are pickled cucumbers or other vegetables in the preparation of which sugar (sucrose) is used.

7. *Sauerkraut* is clean, sound, properly prepared cabbage, mixed with salt, and subjected to fermentation.

8. *Catchup* (*ketchup*, *catsup*) is the clean, sound product made from the properly prepared pulp of clean, sound, fresh, ripe tomatoes, with spices, and with or without sugar and vinegar; *mushroom catchup*, *walnut catchup*, *et cetera*, are catchups made as above described, and conform in name to the substances used in their preparation.

Little need be said under this schedule. The notices of judgment thus far issued and relating to canned vegetables, were on account of underweight and one as to the presence of saccharin. In this latter case, the goods were labelled "Packed with Heyden Sugar." The department has been drawing things to a rather fine point as regards genuine sugar. Corn may not be packed with sugar unless it so appears upon the label. It certainly cannot hurt tomatoes or corn to have a little added sugar, and it seems hard to fine a firm for improving the flavor of its goods with so harmless an ingredient as is sugar. To be just and consistent salt should be classed under the same category. Different lots of a vegetable may vary as to sweetness and a firm does not want *all* of its labels for that product so printed as to cover sugar added.

Decision 92 denied entry into the United States of foods greened with copper, but Decision 102 allows it until further notice. In view of the fact that a tincture of copper is used in Germany as a systemic tonic and that sulphate of copper in small amount is allowed in water to kill algæ, it appears that the minute amount used to green pickles is not liable to be detrimental to health.

Tomato ketchup was fully investigated by the department in an effort to perfect a method of keeping the product without an added preservative. Sterilizing the bottles resulted in too many burns and scalds of operatives, sterilizing after filling resulted in many bottles breaking and tests of the keeping qualities of ketchup destitute of preservative were not very encouraging.

C. SUGARS AND RELATED SUBSTANCES

a. Sugar and Sugar Products

SUGARS

1. *Sugar* is the product chemically known as sucrose (saccharose) chiefly obtained from sugarcane, sugar beets, sorghum, maple, and palm.

2. *Granulated, loaf, cut, milled, and powdered sugars* are different forms of sugar, and contain at least ninety-nine and five-tenths (99.5) per cent of sucrose.

3. *Maple sugar* is the solid product resulting from the evaporation of maple sap, and contains, in the water-free substance, not less than sixty-five one-hundredths (0.65) per cent of maple sugar ash.

4. *Massecuite, melada, mush sugar, and concrete* are products made by evaporating the purified juice of a sugar-producing plant, or a solution of sugar, to a solid or semi-solid consistence, and in which the sugar chiefly exists in a crystalline state.

A large part of commercial "cane" sugar is really made from beets and sulphurous acid is used to bleach it. Really, sugar is a chemical substance and a very complex one at that, and one kind of sugar is convertible into another. Sugar can even be made from formaldehyde and the changes occurring in sugar — containing fruits and other foods are so exceedingly complex that no one fully understands them. Maple sugar differs from cane sugar only in possessing a volatile flavor. In testing for adulteration in maple sugar, we have little to depend upon, except total ash, the so-called "it lead number," and the uncertain polarization test. Other determinations have some value, but as a matter of fact, when largely adulterated (as it very frequently is) the product can be judged by its physical characteristics. The articles under 4 have principally a technical interest. It is a difficult matter to establish standards for sugars. Crude sugar is a disagreeable substance. If you don't believe it, try a trip on a sugar boat or visit a refinery. I have worked sugars chemically just enough to place very little reliance upon some of the tests and the exactly proportioned analyses published.

MOLASSES AND REFINERS' SYRUP

1. *Molasses* is the product left after separating the sugar from massecuite, melada, mush sugar, or concrete, and contains not more than twenty-five (25) per cent of water, and not more than five (5) per cent of ash.

2. *Refiners' syrup, treacle*, is the residual liquid product obtained in the process of refining raw sugars and contains not more than twenty-five (25) per cent of water, and not more than eight (8) per cent of ash.

SYRUP

1. *Syrup* is the sound product made by purifying and evaporating the juice of a sugar-producing plant without removing any of the sugar.

2. *Sugarcane syrup* is syrup made by the evaporation of the juice of the sugarcane or by the solution of sugarcane concrete, and contains not more than thirty (30) per cent of water and not more than two and five tenths (2.5) per cent of ash.

3. *Sorghum syrup* is syrup made by the evaporation of sorghum juice, or by the solution of sorghum concrete, and contains not more than thirty (30) per cent of water, and not more than two and five tenths (2.5) per cent of ash.

4. *Maple syrup* is syrup made by the evaporation of maple sap or by the solution of maple concrete, and contains not more than thirty-two (32) per cent of water.

5. *Sugar syrup* is the product made by dissolving sugar to the consistence of a syrup, and contains not more than thirty-five (35) per cent of water.

The above standards have an academic interest, but the trade is not much concerned about them. I used to help shovel the sugar out of the bottom of the hogsheds of New Orleans molasses and the old "sugar house" molasses that was black and so rich it brought the bees to the store. Those days are past and the trust does just as it pleases with the sugar and molasses business. We take what we get and it is hard upon the pure food people, I know, but I believe they are as helpless as are we consumers. Nearly all of the syrup and molasses one gets now has a little word "blend" or something else to sell flavored glucose. One has difficulty in getting the kind of "brown sugar" necessary to make the ginger cake the "kiddies" of to-day seldom see. I am so disgusted with what the grocer now calls syrup or molasses that I seldom buy any of it. Furthermore, I do not understand why we cannot get *real* molasses any more, and I hope Dr. Wiley will devise some way to curb the sugar trust. Thus far the standards for molasses and syrup are a joke.

As it impresses me, the refiners turn everything into white sugar that can be strained or bleached, and chemistry enables them to do so neat a job that they have only enough real molasses left to flavor the product of their friends, the glucose makers. They have so educated the women up to the white sugar idea that even the syrups are bleached so that they often contain so much sulphur that they are of little account for baking. Glucose may be healthy and chemically correct, but it is only a little pale blue imitation of a big smoke when one wants something to eat. It used to be that the grocery stores made the syrup and molasses barrels a conspicuous part of their stock in trade, but now one sees little but some tin cans filled with "corn syrup" and "baking molasses" marked "compound." Last week my wife tried to make some taffy from one of these wretched but legal abominations, and it was not even any good for that.

b. *Glucose Products*

1. *Starch sugar* is the solid product made by hydrolyzing starch or a starch-containing substance until the greater part of the starch is converted into dextrose. Starch sugar appears in commerce in two forms, anhydrous starch sugar and hydrous starch sugar. The former, crystallized without water of crystallization, contains not less than ninety-five (95) per cent of dextrose, and not more than eight tenths (.8) per cent of ash. The latter, crystallized with the water of crystallization, is of two varieties — 70 sugar, also known as brewers' sugar, contains not less than seventy (70) per cent of dextrose and not more than eight tenths (.8) per cent of ash; 80 sugar, or acme sugar, contains not less than eighty (80) per cent of dextrose and not more than one and one half (1.5) per cent of ash.

The ash of all these products consists almost entirely of chlorides and sulphates.

2. *Glucose, mixing glucose, confectioner's glucose* is a thick, syrupy, colorless product made by incompletely hydrolizing starch, or a starch-containing substance, and decolorizing and evaporating the product. It varies in density from forty-one (41) to forty-five (45) degrees Baume at a temperature of 100 degrees Fahrenheit (37.7° C.), and conforms in density, within these limits, to the degree Baume it is claimed to show, and for a density of forty-one (41) degrees Baume contains not more than twenty-one (21) per cent, and for a density of forty-five (45) degrees not more than fourteen (14) per cent of water. It contains on a basis of forty-one (41) degrees Baume not more than one (1) per cent of ash, consisting chiefly of chlorides and sulphates.

The authorities unite in declaring glucose to be a healthy food and even superior to sucrose. Personally, the matter presents itself to me as true, with certain reservations. Many capable men are more or less afraid of synthetic substances, and it is possible a synthetic sugar might have deleterious effects if too largely used. Human blood and urine contain not over one tenth per cent of glucose normally, but it is the sugar that occurs in diabetes mellitus. In the process of manufacture the sulphuric acid cannot be wholly removed, and it is an undoubted fact that the constant use of this acid does harm to the kidneys. It must not be forgotten that the aldehydes are objected to because they are reducing agents in the body. So is glucose. When glucose is fermented, there is a trace of amyl alcohol resultant and all physicians know what that is. Strange to say, poisoning by amyl alcohol is followed by glucose in the urine. In the human body glucose is oxidized into glycuronic acid, the same substance which appears in the urine after large doses of the synthetic hypnotics, chloral, and some other poisons. As to the practical outcome of such chemical theories we must wait and see.

My own personal views may not amount to much in this regard, but I have never thought the use of glucose does harm when employed in small quantities and for short lengths of time. It is agreed that it is nutritious, but so is the bean, and yet its use for any length of time leads to gastric disturbances. The constant use of glucose impresses me as dangerous, and very apt to lead to serious kidney trouble. I believe its use in the manufacture of beer should be absolutely prohibited.

Candy is mentioned in the standards, and terra alba, barytes, talc, chrome yellow, alcoholic liquor, minerals, and toxic colors are prohibited.

Honey has defined standards and adulteration is prohibited.

Condiments constitute a long list not very interesting to read. There is less adulteration of them than would be expected, and so far as I know, not of a harmful character.

Flavoring extracts constitute another long list hardly worth our space to reproduce. Dilution is common and more or less adulteration is practiced. One is more apt to secure pure goods of this character from a drug store than from other sources.

Edible oils are represented chiefly by olive oil and by cotton seed oil. The former is largely adulterated with the latter. The admixture is perfectly healthy, and to some persons tastes better than does the pure olive oil.

So long as the goods are truly labelled, there can be no objection to their admixture.

Under the last three headings are found an immense number of small questions that may arise, but they are not of a character to interest a physician. The synthetic substitutes are used somewhat in making flavoring extracts. There is seldom any actual danger to health in using these substitutes in small amounts.

E. TEA, COFFEE, AND COCOA PRODUCTS

a. Tea

1. *Tea* is the leaves and leaf buds of different species of *thea*, prepared by the usual trade processes of fermenting, drying, and firing; conforms in variety and place of production to the name it bears; and contains not less than four (4) nor more than seven (7) per cent of ash.

b. Coffee

1. *Coffee* is the seed of *coffea arabica* L., or *coffea liberica* Bull., freed from all but a small portion of its spermoderm, and conforms in variety and place of production to the name it bears.

2. *Roasted coffee* is coffee which by the action of heat has become brown and developed its characteristic aroma, and contains not less than ten (10) per cent of fat, and not less than three (3) per cent of ash.

c. Cocoa and Cocoa Products

1. *Cocoa beans* are the seeds of the cacao tree, *theobroma cacao* L.

2. *Cocoa nibs, cracked cocoa* is the roasted, broken cocoa bean freed from its shell or husk.

3. *Chocolate, plain chocolate, bitter chocolate, chocolate liquor, bitter chocolate coatings* is the solid or plastic mass obtained by grinding cocoa nibs without the removal of fat or other constituents except the germ, and contains not more than three (3) per cent of ash insoluble in water, three and fifty hundredths (3.50) per cent of crude fiber, and nine (9) per cent of starch, and not less than forty-five (45) per cent of cocoa fat.

4. *Sweet chocolate, sweet chocolate coatings* is chocolate mixed with sugar (sucrose), with or without the addition of cocoa butter, spices, or other flavoring materials, and contains in the sugar and fat-free residue no higher percentage of either ash, fiber, or starch than is found in the sugar and fat-free residue of chocolate.

5. *Cocoa, powdered cocoa* is cocoa nibs, with or without the germ, deprived of a portion of its fat and finely pulverized, and contains percentages of ash, crude fiber, and starch corresponding to those in chocolate after correction for fat removed.

6. *Sweet cocoa, sweetened cocoa* is cocoa mixed with sugar (sucrose), and contains not more than sixty (60) per cent of sugar (sucrose), and in the sugar and fat-free residue no higher percentage of either ash, crude fiber, or starch than is found in the sugar and fat-free residue of chocolate.

Tea is a largely used substance in this country, but one very little investigated by American authorities. "Parke's Hygiene" describes adulteration

with the leaves of willow, sloe, oak, plane, beach, elm, hawthorne, and chestnut, the admixture not being made at the point of origin. The Chinese have been charged with adulteration with chloranthus and camellia.

From microscopical examination of several brands, made by myself, no adulteration was found except the use of too old and half dead leaves, and they were found only in the cheaper grades.

New Hampshire has fully investigated coffee and their last report says:

There is now practically no adulterated coffee upon the market, the sale of mixtures including chicory and cereals being a thing of the past. A large amount of coffee of excellent flavor and of low price is now being imported from Central and South America. The principal problem in connection with the sale of these varieties is to prevent their being offered under improper geographical names.

The so-called "detanated" coffee contains the normal amount of tannin. "Refined Coffee, Digesto Brand" was adjudged misbranded, and the claims fraudulent (Notice of Judgment, No. 4) and the labeling of coffee produced in the Dutch East Indies and of Java and Mocha coffees have all been subjects of decisions. The coating of coffee with lead chromate is illegal and a dangerous adulteration. F. I. D. 80 demands that coated coffees be labelled with the ingredients of the matter used to coat them. Roasters of coffee have been using a mixture of lemon juice, flaxseed, gelatine, sodium bicarbonate, and lime water. The object was to glaze the coffee and to reduce loss in weight during roasting. Coffee has, in the past, been largely adulterated, the principal adulterant being chicory, a substance not detrimental to health. The claims of the manufacturers of the so-called "cereal coffees" are ridiculous, both as to the poisonous properties of coffee and the value of their substitutes.

Cocoa or chocolate is largely adulterated, but from some personal examination of the bean, I can well realize that fermentation and a certain admixture of sugar and flavors is necessary in the production of an acceptable commercial article. Dr. Wiley's report for 1908, says:

Some low-priced goods are shown to be wholly fictitious, being composed largely of a glucose paste artificially colored and flavored. Others contain only shells as the cocoa constituent. Many of the penny goods, especially the so-called chocolate cigars and cigarettes, are coated with resin varnishes, and the latter are being investigated and identified when possible. A number of samples contain substitutes for cocoa butter, and these extracted fats, as well as substitutes sold as such, have been carefully examined and their constants determined.

F. BEVERAGES

(a) *Fruit Juices.* (1) *Fresh* and (2) *Sweet.*

The federal government has not fully completed the schedules.

Louisiana has established standards, inclusive of sweet cider, grape juice, lemon juice, sweet perry, sterilized fruit juices, and concentrated fruit juices and syrups. The matter is of importance chiefly as regards the soda

water trade. It has been found that some of the grape juice upon the market is fermented or, in other words, is wine. Until recently, practically all of the made up syrups and jams for the soda fountain were preserved with benzoates. But the J. Hungerford Smith Company, probably the largest makers of these goods, announced that they had abandoned the use of preservatives, except sugar. The others in the trade will probably be obliged to do the same thing.

Dr. Wiley's report for 1908 has this to say about some syrups and tonic drinks used at the soda fountain:

During the year the properties of the beverages of the "cola type" have been ascertained by chemical research, and their composition determined by careful chemical analysis. These results have been of very distinct value in a practical way. The influence of such a drug as caffeine, often present in medicated beverages of this kind, varies greatly with different individuals, making it desirable that the public should know the character of the stimulant they are buying.

It is generally believed that an alkaloid, like caffeine, when its natural form of combination is destroyed and it is administered in a pure state, is made much more active thereby, and this should be remembered when considering the amount of caffeine present in medicated beverages of this type as compared with that in coffee or tea. Moreover, a person who drinks tea or coffee is aware of the fact that he has taken into his system alkaloidal material which when used in excess may prove injurious, while the drinker of the cola beverages is wholly unaware of the nature of the drug consumed. Investigations have shown that the continued use of such beverages may be injurious, and their indiscriminate use by those ignorant of their nature should be controlled. This is especially true in view of their excessive use by individuals, and the rapid increase of beverages of this type varying in harmfulness.

The California Board found seventy-nine out of one hundred and thirteen samples of soda water were adulterated principally with coal tar colors used to conceal the use of inferior materials. The coca wines are even worse. There is no need for wines of coca even in the U. S. P., according to the ideas of some persons, an idea with which I am inclined to agree. Pop or bottled soda water, meade, root beer, etc., are often adulterated.

FERMENTED FRUIT JUICES

1. *Wine* is the product made by the normal alcoholic fermentation of the juice of sound, ripe grapes, and the usual cellar treatment, and contains not less than seven (7) nor more than sixteen (16) per cent of alcohol, by volume, and in one hundred (100) cubic centimeters (20°C.), not more than one tenth (.1) gram of sodium chloride, nor more than two tenths (.2) gram of potassium sulphate: and for red wine not more than fourteen hundredths (.14) gram, and for white wine not more than twelve hundredths (.12) gram of volatile acids produced by fermentation and calculated as acetic acid. Red wine is wine containing the red coloring matter of the skins of grapes. White wine is wine made from white grapes, or the expressed fresh juice of other grapes.

2. *Dry wine* is wine in which the fermentation of the sugars is practically complete, and which contains, in one hundred (100) cubic centimeters (20°C.), less than one (1) gram of sugars, and for dry red wine not less than sixteen hundredths (0.16) gram of grape ash and not less than one and six tenths (1.6) grams of sugar-free grape solids, and for dry white wine not less than thirteen hundredths (.13) gram

of grape ash and not less than one and four tenths (1.4) grams of sugar-free grape solids.

3. *Fortified dry wine* is dry wine to which brandy has been added, but which conforms in all other particulars to the standard of dry wine.

4. *Sweet wine* is wine in which the alcoholic fermentation has been arrested, and which contains, in one hundred (100) cubic centimeters (20°C.), not less than one (1) gram of sugars, and for sweet red wine not less than sixteen hundredths (.16) gram of grape ash, and for sweet white wine not less than thirteen hundredths (.13) gram of grape ash.

5. *Fortified sweet wine* is sweet wine to which wine spirits have been added. By act of Congress, "sweet wine" used for making fortified sweet wine and "wine spirits" used for such fortification are defined as follows (sec. 43, Act of October 1, 1890, 26 Stat., 567, as amended by section 68, Act of August 27, 1894, 28 Stat., 509, and further amended by Act of Congress approved June 7, 1906): "That the wine spirits mentioned in section 42 of this act is the product resulting from the distillation of fermented grape juice to which water may have been added prior to, during, or after fermentation, for the sole purpose of facilitating the fermentation and economical distillation thereof, and shall be held to include the products from grapes or their residues, commonly known as grape brandy; and the pure sweet wine, which may be fortified free of tax, as provided in said section, is fermented grape juice only, and shall contain no other substance whatever introduced before, at the time of, or after fermentation except as herein expressly provided; and such sweet wine shall contain not less than four per centum of saccharine matter, which saccharine strength may be determined by testing with Balling's saccharometer or must scale such sweet wine after the evaporation of the spirits contained therein, and restoring the sample tested to original volume by addition of water: *Provided*, that the addition of pure boiled or condensed grape must or pure crystallized cane or beet sugar or pure anhydrous sugar to the pure grape juice aforesaid, or the fermented product of such grape juice prior to the fortification provided by this act for the sole purpose of perfecting sweet wine according to commercial standard, or the addition of water in such quantities only as may be necessary in the mechanical operation of grape conveyers, crushers, and pipes leading to fermenting tanks, shall not be excluded by the definition of pure sweet wine aforesaid: *Provided, however*, that the cane or beet sugar, or pure anhydrous sugar, or water, so used shall not in either case be in excess of ten (10) per centum of the weight of the wine to be fortified under this act: *And provided further*, that the addition of water herein authorized shall be under such regulations and limitations as the commissioner of internal revenue, with the approval of the secretary of the treasury, may from time to time prescribe; but in no case shall such wines to which water has been added be eligible for fortification under the provisions of this act where the same, after fermentation and before fortification, have an alcoholic strength of less than five per centum of their volume."

6. *Sparkling wine* is wine in which the after part of the fermentation is completed in the bottle, the sediment being disgorged and its place supplied by wine or sugar liquor, and which contains, in one hundred (100) cubic centimeters (20°C.), not less than twelve hundredths (.12) gram of grape ash.

7. *Modified wine, ameliorated wine, corrected wine* is the product made by the alcoholic fermentation, with the usual cellar treatment, of a mixture of the juice of sound, ripe grapes with sugar (sucrose), or a syrup containing not less than sixty-five (65) per cent of sugar (sucrose), and in quantity not more than enough to raise the alcoholic strength after fermentation, to eleven (11) per cent by volume.

8. *Raisin wine* is the product made by the alcoholic fermentation of an infusion

of dried or evaporated grapes, or of a mixture of such infusion or of raisins with grape juice.

The writer believes that whatever views one may entertain as to the use of liquors and wines, it is important that these products be placed upon a high standard. There is a tendency in some quarters to charge our wines with being badly made and seriously adulterated. I never use wine and very rarely indeed prescribe it, but when I examined the available evidence as to the quality of American wines, it was not at all hard to prove that the principal vineyards and makers turn out a very creditable product and that adulteration is not at all common. As to some wholesale dealers and the proprietors of saloons, the least said the better, for wines get all kinds of treatment from these men, depending upon the character of the man. If one wishes a good wine, it is best to purchase the original package of some reliable make and to avoid "bottled for" labels and the brand of a man known to be not a producer himself.

C. MALT LIQUORS

1. *Malt liquor* is a beverage made by the alcoholic fermentation of an infusion in potable water, of barley-malt and hops, with or without malted cereals.

2. Beer is a malt liquor produced by bottom fermentation, and contains in one hundred (100) cubic centimeters, at (20°C.), not less than five (5) grams of extractive matter, and sixteen one-hundredths (.16) gram of ash, chiefly potassium phosphate, and not less than two and twenty-five one-hundredths (2.25) grams of alcohol.

3. *Lager beer, stored beer* is beer which has been stored in casks for a period of at least three months, and contains in one hundred (100) cubic centimeters, at (20° C.), not less than five (5) grams of extractive matter, and sixteen one-hundredths (.16) gram of ash, chiefly potassium phosphate, and not less than two and fifty one-hundredths (2.50) grams of alcohol.

4. *Malt beer* is beer made of an infusion of potable water, of barley malt, and hops, and containing in one hundred (100) cubic centimeters, at (20°C.), not less than five (5) grams of extractive matter, nor less than two tenths (.2) gram of ash, chiefly potassium phosphate, nor less than two and twenty-five one-hundredths (2.25) grams of alcohol, nor less than four tenths (.4) gram of crude protein (Nitrogen X 6.25).

5. *Ale* is a malt liquor produced by top fermentation, and contains in one hundred (100) cubic centimeters at (20° C.) not less than two and seventy-five one-hundredths (2.75) grams of alcohol, nor less than five (5) grams of extract.

6. *Porter and Stout* are varieties of ale colored by the addition of highly roasted malt to the infusion.

The federal department has not fully perfected its standards for malt liquors, and the commercial interests involved are making it a difficult matter to do so. But the standards of Louisiana for malt and spirituous liquors impress me as so fair and so liable to parallel the federal ones that they are reproduced here.

Under them a large portion of the beer made in the United States would be misbranded if labelled "*Lager Beer*," a product largely used in Europe, and by the discriminating trade in this country. Lager beer involves quite a

prolonged process in the brewing. The grain is malted, "couched," and "floored," and finally kiln dried. A "mash" is then made and, in due time, the "wort" is drawn off and boiled for four hours. Hops are added during the last hour of boiling and the resultant fluid is cooled. Then yeast is added and fermentation proceeds at a comparatively low temperature. This beer is then settled and run into casks and "lagered" or stored for from five to eight months, finally "fined," and a little new beer added before bottling. In Bavaria the law allows no other ingredients to be added. Such beer is *really* lager beer, and keeps for a long time if not opened.

It is easy to tell whether a brewery is making lager beer or "just beer," since a lager beer brewery has a comparatively small brew house and a very large stock or store house. All the comment necessary is to say that American breweries are usually "not built that way."

Good lager beer contains about one ounce of alcohol to the pint and has a nutritive value sufficient to make it about as hard to drink it to excess as it is to drink milk to excess. However, long practice can make a man guzzle most anything he has a mind to and even lager beer. The average person uses lager beer with his meals and cannot consume large quantities in between. Lager beer is fattening and is a mild stomachic tonic, but produces billiousness in persons with a weak digestion, or in those who consume it in quantity. That it has a certain food value goes without saying, but to call it "fluid bread" is pure nonsense. There are "brewers" in this country who will deny nearly all of these statements. All I have to say is that they know better. My only criticism of the Louisiana standards is that they should require not less than *six months* lagering and the product be sealed or bonded for that time by a government inspector. Such lager beer could not be retailed for the present prices of American beer, but the consumer would gain in the end, because he would consume fewer bottles and would not be nearly so liable to injure his health or become a drunkard.

Beer and malt beer of the schedule are honestly made by some of the brewers, and here in America there is a demand for these light and crude beers that it is only reasonable to recognize so long as the laws are as they are. But well-defined standards for these American beers should be enforced and no glucose, rice, chemicals, or extractives, preservatives, or coloring matters should be permitted in any grade of beer. Beer and malt beer cannot, even with the best of materials, approach lager beer from the hygienic standpoint and are very raw products.

Much beer contains little but water, alcohol, and bitter principles. Other classes contain a little malt and hops, but the bulk of the material used is glucose and broken rice. These are alleged beers and the American market is flooded with such slop. Incalculable harm is being done to the poorer classes of our citizens by them and not one good word can be said for such "beverages." It is high time that the federal government and the states put an end to the brewing and sale of such concoctions. Be it said to their credit that the honorable men in the brewing business will agree with what is here said, and they also realize that if this and other semi-criminal practices of certain men in the trade is not stopped by the better element in the business,

an outraged public sentiment that is demanding better things will flock to the standard of the local option people, or any other movement that will punish the *whole* liquor trade for the sins of the scrub element therein.

The liquid extracts of malt sold for medical purposes are really a high grade of beer low in alcohol content. There should be a standard for them. As a matter of fact, some of the makes generally understood to be made abroad are really made in this country, and are in no wise superior to the makes of our pharmaceutical houses and a few of the large breweries.

The writer has at hand a number of analyses of specified makes of American beers, some showing very discredibly and others revealing considerable care in manufacture and after handling. It does not impress me as wise to republish analyses that may have already caused a change in methods of the breweries involved. However, it is true that there is a temptation to make bad beer and constant supervision will be necessary in the enforcement of regulations, providing for a higher ethics and honesty in the brewing business.

The internal revenue officials have done much to improve the quality of spirituous liquors in this country so far as the distillers are involved. The trouble is with the rectifiers, blenders, wholesale dealers, bottlers, saloon keepers, and a certain class of men posing as pharmacists. Every possible concoction is sold as whiskey or merely as "liquor," and it is very hard to suppress this traffic in bad whiskey and other intoxicants. The mere labeling of a bottle as "blend," or by any other name does not protect the man who gets it over the bar or who is not posted as to government requirements. The New Hampshire Board reports that of two hundred and sixty-four samples of whiskey submitted, but twenty-four — less than ten per cent could be classed as straight. As they state:

The others were (1) what the rectifiers and bottlers choose to designate as "blends" but which are properly compounds, i.e., mixtures of straight whiskey with artificial, and (2) products that the rectifiers refer to as "compound whiskey," but which are not logically entitled to such naming for the reason, that a compound whiskey must contain some genuine whiskey, whereas this second class of products is wholly artificial. The board states that over ninety-five per cent of liquor sold over the bars of New Hampshire is compound or artificial. They make a scathing arraignment of bottled liquor, naming therein many of the more prominent brands sold generally over the United States.

LOUISIANA STANDARDS FOR

D. SPIRITUOUS LIQUORS

1. *Distilled spirits* is the distillate obtained from a fermented mash of cereals, molasses, sugars, fruits, or other starch or sugar-bearing substances, and contains all the condensed products of the fermentation volatile at the usual temperature of distillation.

2. *Rectified spirits* is distilled spirit which at the time of, or subsequent to distillation is subjected to a rectifying process by means of which a part of the volatile products of the distillation is separated from the ethyl alcohol therein.

3. *Alcohol, cologne spirit, neutral spirit, velvet spirit, or silent spirit* is distilled spirit from which all, or nearly all, its constituents are separated, except ethyl alcohol and water, and contains not less than ninety-four and nine tenths (94.9) per cent (189.8 proof) by volume of ethyl alcohol.

4. *New whiskey* is the distilled spirits from the properly fermented mash of malt cereals, or cereals the starch of which has been hydrolized by malt, is of an alcoholic strength corresponding to the excise laws of the various countries in which it is made, and contains not less than one hundred and twenty-five (125) nor more than three hundred and fifty (350) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than ninety (90) nor more than two hundred and twenty-five (225) grams of fusel oil (higher alcohols as amylic), not more than twenty (20) grams of aldehydes, not less than fifteen (15) nor more than one hundred (100) grams of ethers (as acetic ether), not less than two (2) nor more than twenty-five (25) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

5. *Whiskey (potable whiskey)* is new whiskey which has been stored in wood for not less than four (4) years, and mixed only with pure water at the time of its preparation for consumption, and contains, unless otherwise prescribed by law, not less than forty-five (45) per cent of ethyl alcohol by volume, and the relative quantities of secondary products to ethyl alcohol corresponding to the varieties of whiskey under six (6) to fifteen (15) inclusive.

6. *Rye whiskey* is whiskey in the manufacture of which rye is the principal cereal used, and contains not less than two hundred (200) nor more than five hundred (500) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than one hundred (100) nor more than two hundred and fifty (250) grams of fusel oil (higher alcohols as amylic), not more than twenty-five (25) grams of aldehydes, not less than forty (40) nor more than one hundred and fifty (150) grams of ethers (as acetic ether), not less than thirty (30) nor more than eighty-five (85) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

7. *Bourbon whiskey* is whiskey in which Indian corn (maize) is the principal cereal used, and contains not less than two hundred (200) nor more than five hundred (500) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than one hundred (100) nor more than two hundred and fifty (250) grams of fusel oil (higher alcohols as amylic), not more than twenty-five (25) grams of aldehydes, not less than forty (40), nor more than one hundred and fifty (150) grams of ethers (as acetic ether), not less than thirty (30), nor more than eighty-five (85) grams of volatile acids (as acetic) to one hundred litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

8. *Corn whiskey* is whiskey made from maize (Indian corn), the starch of which has been hydrolized by malting or by the action of barley malt, and contains the proportions of the various ingredients specified for bourbon whiskey.

9. *Arrack* is distilled spirit made from rice.

10. *Blended whiskey* is a mixture of two or more whiskeys, and contains the relative quantities of secondary products to ethyl alcohol of the varieties of whiskey forming the blend.

11. *Rectified new whiskey* is new whiskey deprived of a part of its secondary volatile products, and contains not less than sixty (60) grams of the secondary volatile products of distillation congeneric with ethyl alcohol, not less than forty (40) grams of fusel oil (higher alcohol as amylic), not more than eight (8) grams of aldehydes, not less than five (5) grams of ethers (as acetic ether), not less than one (1) gram of

volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent of ethyl alcohol by volume).

12. *Rectified whiskey* is rectified new whiskey stored in wood not less than three (3) years, except where otherwise prescribed by law, and contains not less than one hundred (100) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than fifty (50) grams of fusel oil (higher alcohols as amylic), not more than ten (10) grams of aldehydes, not less than twenty (20) grams of ethers (as acetic ether), not less than fifteen (15) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

13. *Scotch new whiskey* is whiskey made in Scotland solely from barley malt, in the drying of which over burning peat a smoky or peaty flavor is imparted to the product, and contains not less than one hundred and twenty-five (125), nor more than three hundred and fifty (350) grams of the secondary product of distillation congeneric with ethyl alcohol, not less than ninety (90), nor more than two hundred and twenty-five (225) grams of fusel oil (higher alcohols as amylic), not more than twenty (20) grams of aldehydes, not less than fifteen (15), nor more than one hundred (100) grams of ethers (as acetic ether), not less than two (2) nor more than twenty-five (25) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

14. *Scotch whiskey* is Scotch new whiskey which has been stored in wood for not less than four years, and mixed only with pure water at the time of its preparation for consumption, and contains not less than one hundred and fifty (150), nor more than four hundred and fifty (450) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than one hundred (100), nor more than two hundred and fifty (250) grams of fusel oil (higher alcohols as amylic), not more than twenty-five (25) grams of aldehyde, not less than twenty-five (25), nor more than one hundred and twenty-five (125) grams of ethers (as acetic ether), not less than ten (10) nor more than forty (40) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

15. *Irish new whiskey* is whiskey made in Ireland, either from barley malt, or malt and unmalted barley, or other cereals, and contains not less than one hundred and twenty-five (125) nor more than three hundred and fifty (350) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than ninety (90) nor more than two hundred and twenty-five (225) grams of fusel oil (higher alcohols as amylic), not more than twenty (20) grams of aldehydes, not less than fifteen (15) nor more than one hundred (100) grams of ethers (as acetic ether), not less than two (2) nor more than twenty-five (25) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

16. *Irish whiskey* is Irish new whiskey which has been stored in wood for not less than four years and mixed only with pure water at the time of its preparation for consumption, and contains not less than one hundred and fifty (150) nor more than four hundred and fifty (450) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than one hundred (100) nor more than two hundred and fifty (250) grams of fusel oil (higher alcohols as amylic), nor more than twenty-five (25) grams of aldehydes, not less than twenty-five (25) nor more than one hundred and twenty-five (125) grams of ethers (as acetic ether), not less than ten (10) nor more than forty (40) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

17. *New rum* is distilled spirits made from the fermented juice of the sugarcane, the massecuite made therefrom, molasses from the massecuite or any intermediate product save sugar, and contains not less than one hundred and twenty-five (125)

nor more than three hundred and fifty (350) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than sixty (60) nor more than one hundred and fifty (150) grams of fusel oil (higher alcohols as amylic), not more than thirty (30) grams of aldehydes, not less than thirty (30) nor more than one hundred (100) grams of ethers (as acetic ether), not less than twenty nor more than fifty (50) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

18. *Rum* is new rum stored not less than four (4) years in wood, and contains not less than one hundred and seventy-five (175) nor more than five hundred (500) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than eighty (80) nor more than two hundred (200) grams of fusel oil (higher alcohols as amylic), not more than forty (40) grams of aldehydes, not less than fifty (50) nor more than one hundred and fifty (150) grams of ethers (as acetic ether), not less than thirty-five (35) nor more than one hundred (100) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

19. *New brandy* is a distilled spirit made from sound potable wine, and contains not less than one hundred and twenty-five (125) nor more than three hundred and fifty (350) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than seventy (70) nor more than one hundred and fifty (150) grams of fusel oil (higher alcohols as amylic), nor more than twenty (20) grams of aldehydes, not less than thirty (30) nor more than one hundred (100) grams of ethers (as acetic ether), not less than five (5) nor more than twenty (20) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

20. *Brandy* is new brandy stored in wood for not less than four (4) years, and contains not less than one hundred and fifty (150) nor more than five hundred (500) grams of the secondary products of distillation congeneric with ethyl alcohol, not less than eighty (80) nor more than two hundred (200) grams of fusel oil (higher alcohols as amylic), not more than thirty (30) grams of aldehydes, not less than thirty-five (35) nor more than one hundred and fifty (150) grams of ethers (as acetic ether), not less than thirty (30) nor more than one hundred (100) grams of volatile acids (as acetic) to one hundred (100) litres of proof ethyl alcohol (50 per cent ethyl alcohol by volume).

21. *Cognac* is brandy prepared in the departments of the Charente, France, from pure, sound wine produced in those departments.

These Louisiana standards have been carefully worked out and by comparison with standard literature will impress any one as fair, but some modification must be expected after due experience. From a medical point of view, it impresses me that the sale of artificial whiskeys should be absolutely prohibited, that sharp standards should be established for "cordials," and that absinthe should be denied entrance to the country, and that medicated wines and liquors be rigidly regulated.

It impresses me that sufficient has been said under this heading, and those desiring the point of view of the federal department can consult food inspection decisions 65, 85, 95, and 98; as well as notices of judgment 45, 51, and others.

Carbonated waters are to be under a schedule, some of the states having recently provided therefor. Pennsylvania has a brand new law that promises exceedingly well and suits are being instituted wholesale for selling adulter-

ated soda water. The conditions found by the analysts are a disgrace to the makers of fountain supplies. Some of the makers have been strenuously fighting for a law compelling the abandonment of the shameless adulteration commonly practiced.

G. VINEGAR

1. *Vinegar, cider vinegar, apple vinegar* is the product made by the alcoholic and subsequent acetous fermentations of the juice of apples, is lævo-rotatory, and contains not less than four (4) grams of acetic acid, not less than one and six tenths (1.6) grams of apple solids, of which not more than fifty (50) per cent are reducing sugars, and not less than twenty-five hundredths (.25) gram of apple ash in one hundred (100) cubic centimeters (20° C.); and the water-soluble ash from one hundred (100) cubic centimeters (20° C.) of the vinegar contains not less than ten (10) milligrams of phosphoric acid (P_2O_5), and requires not less than thirty (30) cubic centimeters of decinormal acid to neutralize its alkalinity.

2. *Wine vinegar, grape vinegar* is the product made by the alcoholic and subsequent acetous fermentations of the juice of grapes and contains, in one hundred (100) cubic centimeters (20° C.), not less than four (4) grams of acetic acid, not less than one (1.0) gram of grape solids, and not less than thirteen hundredths (.13) gram of grape ash.

3. *Malt vinegar* is the product made by the alcoholic and subsequent acetous fermentations, without distillation, of an infusion of barley malt or cereals whose starch has been converted by malt, is dextro-rotatory, and contains, in one hundred (100) cubic centimeters (20° C.), not less than four (4) grams of acetic acid, not less than two (2) grams of solids, and not less than two tenths (.2) gram of ash; and the water-soluble ash from one hundred (100) cubic centimeters (20° C.) of the vinegar contains not less than (9) milligrams of phosphoric acid (P_2O_5), and requires not less than four (4) cubic centimeters of decinormal acid to neutralize its alkalinity.

4. *Sugar vinegar* is the product made by the alcoholic and subsequent acetous fermentations of solutions of sugar, syrup, molasses, or refiners' syrup, and contains, in one hundred (100) cubic centimeters (20° C.), not less than four (4) grams of acetic acid.

5. *Glucose vinegar* is the product made by the alcoholic and subsequent acetous fermentations of solutions of starch sugar or glucose, is dextro-rotatory, and contains, in one hundred (100) cubic centimeters (20° C.), not less than four (4) grams of acetic acid.

6. *Spirit vinegar, distilled vinegar, grain vinegar* is the product made by the acetous fermentation of dilute distilled alcohol, and contains, in one hundred (100) cubic centimeters (20° C.), not less than four (4) grams of acetic acid.

III. SALT

1. *Table salt, dairy salt* is fine-grained crystalline salt containing on a water-free basis not more than one and four tenths (1.4) per cent of calcium sulphate ($CaSO_4$), nor more than five tenths (.5) per cent of calcium and magnesium chlorides ($CaCl_2$ and $MgCl_4$), nor more than one tenth (.1) per cent of matters insoluble in water.

The Tennessee Board has carefully investigated vinegars and found sixty per cent adulterated.

IV. BAKING POWDERS

Baking powders must consist only of wholesome materials, the names of which shall be stated on the label, and shall give at least ten (10) per cent of their own weight of carbonic acid gas on addition of water.

Pennsylvania absolutely excludes baking powders containing alum. Many baking powders are impure as to the quality of their ingredients.

Preservatives and dyes.— In the heat of forensic debate it is hard to write judiciously upon any question. For several months the writer has been following up the involved question of food preservatives and coloring matters. Doubtless both sides are extreme in statement and I will here endeavor to state moderate views, but not write the history of the contention. However, a reference to the main incidents may be permitted. F. I. D., December 26, 1908, said:

Frequent inquiries have been received by the department in regard to the use of benzoate of soda in foods. The following is typical of this class of inquiries:

In F. I. D. 89, the position of the national authorities in regard to the use of benzoate of soda is to allow its use in food, pending the report of the Referee Board of Consulting Scientific Experts. Based upon Bulletin 84, Part IV, of the Bureau of Chemistry, issued subsequent to F. I. D. 89, certain manufacturers of food products are representing to the officials of the states, charged with the enforcement of food laws, and to the consuming public generally, that the U. S. Government has condemned the use of benzoate in foods. We write to ask the position of the department on this subject.

The department has not changed the position outlined in Food Inspection Decision 89. Pending the determination by the Referee Board of the wholesomeness or unwholesomeness of benzoate of soda, its use will be allowed under the following restrictions:

Benzoate of soda, in quantities not exceeding one tenth of one per cent, may be added to those foods in which generally heretofore it has been used.

The addition of benzoate of soda shall be plainly stated upon the label of each package of such food.

F. L. DUNLAP,
GEO. P. McCABE,
Board of Food and Drug Inspection

This can be certainly taken as the position of the federal authorities, despite all of the inspired or sensational utterances of the newspapers. This is based upon F. I. D. 89, as follows:

Pending determination by the Referee Board of the wholesomeness or unwholesomeness of these substances, their use will be allowed under the following restrictions:

Benzoate of soda in quantities not exceeding one tenth of one per cent may be added to those foods in which generally heretofore it has been so used. The addition of benzoate of soda shall be plainly stated upon the label of each package of such food.

No objection will be made to foods which contain the ordinary quantities of sulphur dioxide, if the fact that such foods have been so prepared is plainly stated upon the label of each package.

An abnormal quantity of sulphur dioxide placed in food for the purpose of marketing an excessive moisture content will be regarded as fraudulent adulteration, under the Food and Drugs Act of June 30, 1906, and will be proceeded against accordingly.

Under date of March 3, 1909, F. I. D. 104 was issued. From it I take the gist of the report of the Referee Board as follows:

The same general plan of procedure was followed in all three experiments. A certain number of healthy young men were selected as subjects, and during a period of four months these men, under definite conditions of diet, etc., with and without sodium benzoate, were subjected to thorough clinical and medical observation, while the daily food and the excretions were carefully analyzed and otherwise studied, and comparison made of the clinical, chemical, bacteriological, and other data collected. (For details, see the individual reports.) In this manner material has been brought together which makes possible conclusions regarding the effect of small and large doses of sodium benzoate upon the human system.

In fixing upon the amount of sodium benzoate that should constitute a "small dose," we have adopted .3 gram of the salt per day. Manufacturers of food products, which in their view require the use of a preservative, are in general content with .1 per cent of sodium benzoate. This would mean that in the eating of such a preserved food the consumer would need to take three hundred grams per day, or nearly two thirds of a pound of preserved food to ingest an amount of benzoate equal to our minimal daily dosage. Looked at from this point of view, our dosage of .3 gram per day seemed a fair amount for a "small dose," one that would clearly suffice to show any effect that small doses of the salt might exert, especially if continued for a considerable length of time. In all these for experiments this daily dosage was continued for a period of about two months. Under "large dose" was included quantities of sodium benzoate ranging from 2.6 to 4 grams per day. Such a daily dosage was continued for a period of one month. In a few instances somewhat larger doses were employed.

As the amount and character of the daily diet exert a well-known influence upon many of the metabolic or nutritive changes of the body, as well as upon the bacterial flora of the intestines, attention is called to the fact that the three investigations differed from each other in the amount of protein food consumed daily, thereby introducing a distinctive feature which tends to broaden the conditions under which the experiments were conducted.

The conclusions reached as a result of the individual investigations are given at length in the separate reports herewith presented, together with all of the data upon which these conclusions are based.

The fact should be emphasized that the results obtained from the three separate investigations are in close agreement in all essential features.

The main general conclusions reached by the Referee Board are as follows:

1. Sodium benzoate in small doses (under .5 gram per day) mixed with the food is without deleterious or poisonous action, and is not injurious to health.
2. Sodium benzoate in large doses (up to four grams per day) mixed with the food has not been found to exert any deleterious effect on the general health, nor to act as a poison in the general acceptance of the term. In some directions there were slight modifications in certain physiological processes, the exact significance of which modifications is not known.

3. The admixture of sodium benzoate with food in small or large doses has not been found to injuriously affect or impair the quality or nutritive value of such food.

IRA REMSEN, *Chairman*

RUSSELL H. CHITTENDEN

JOHN H. LONG

CHRISTIAN A. HERTER

Referee Board of Consulting Scientific Experts

There is nothing sensational in this report, and any physician is at liberty to agree or to disagree with any or all of its conclusions. The textbooks pretty generally agree that one tenth per cent of sodium benzoate will *prevent* the development of bacteria and that four tenths per cent will destroy most of the bacteria of decomposition. If the canners expect to offer goods that have not been sterilized, their trade should suffer, as no excuse can be offered for selling canned fruits that have not been put into the cans sterile. Possibly pickles and mince meat are exceptions. Therefore, in the case of goods consumed very soon after opening the cans, what excuse is there for using over one tenth per cent of benzoate? With pickles, mince meat, salad dressings, and catsup, the opened packages may not be consumed for several days. When we consider that the vinegar and spices go a long way to preserve such products, surely a very small amount of benzoate will preserve these products. I know that tomatoes and corn are hard to keep and a little benzoate may be justified with them.

As has been intimated before, there is a second grade of canned and preserved foods in which glucose and inferior but wholesome foods are used. They might need a trace of benzoate. It can be no hardship for the maker to label the benzoated goods and he should do so.

Personally, a trial of natural benzoates and synthetic ones impressed me with the opinion that the synthetic products are much more irritating than are natural benzoates, but my experiments were not sufficient to constitute a scientific demonstration, and I am unable to find reliable data answering my natural question as to whether the natural benzoates are of the same anti-septic value as are the synthetic ones. In therapeutics I am entirely satisfied that the natural salts are to be preferred to the synthetics. But this is simply my own opinion, given for what it is worth. Dr. W. W. Smith, a physiologic chemist of New York city, tells me that made from tolual is not deleterious in one gram doses per twenty-four hours.

Some of the advanced manufacturers do not use any chemical preservatives and the recently enacted Pennsylvania law does not permit of more than one tenth per cent of benzoates. A whole list of chemical preservatives are forbidden. Boron derivatives are still desired by some of the meat packers, but the whole question is working itself out commercially.

As to sulphurous acid, when it is used as a bleach or preservative in the commercial preparation of sugar, molasses, evaporated fruit, and sulphuring of wine casks, it is believed that harmless compounds result except when an excess of the acid is used.

As regards coloring matters, the federal and state authorities permit the use of certain coloring matters not prejudicial to health. As listed in A. G.

Green's edition of the Schultz-Julius Systematic Survey of the Organic Coloring Matters, published in 1904, the following are permitted:

Red shades — 107 Amaranth; 56 Ponceau 3R; 517 Erythrosin.

Orange shade — 85 Orange I.

Yellow shade — 4 Naphthol yellow S.

Green shade — 435 light green S. F. yellowish

Blue shade — 692 indigo disulfoacid.

The coloring matters used in the U. S. P.

Other coloring matters will be added as their harmlessness is demonstrated.

Finally it must be admitted by all that even as a pharmacopœia is needed for a drug standard, even so food standards are necessary for the determination of food values and their legal status, especially in cases at law and to form a basis of contracts and comparison.

There has been a vast deal of senseless criticism of the pure food and drug people. They are attempting a vast work and one of the highest value as regards public health.

The editor has used his own means for personally estimating the real status of the administration of the work, and has tried to find out the real problems of the food packers and manufacturers. When the federal work first got under way, I found a good many utterly incapable men working in various capacities. Many of them were a gloomy failure, although they had passed excellent civil service examinations. But that day is pretty well gone, for most of these people merely lacked in an experience that has made efficient officers of them. I know, from observation, that the federal department is doing a splendid work, and Dr. Wiley has courageously forged ahead against a very assertive coterie of manufacturers and allied politicians who feared that honesty was *not* the best policy. A few object lessons and an aroused public has opened their eyes to the fact that a food factory can be honest and still make money.

The states are in various degrees of legislation or attempted enforcement of food and drug laws. The general outlook is encouraging.

As to the general practitioner of medicine, he owes it to his patients and to the community to do all in his power to uphold the general purpose of the law. It may be a bit tedious to read through the details of a chapter such as this, but it presents many matters concerning which the doctor should be informed.

P.S. No new standards have been adopted up to the date of issuance of this book. The food inspection decisions and court judgments of recent date add nothing new. The Denver Convention suggested some new enactments. Dr. Wiley informs me that it would be necessary to enact a new law, to include tobacco within the scope of the food and drug act. The spread of pellagra in the United States makes it necessary to more carefully inspect corn and corn products.

ILLUSTRATIONS OF GOOD PRACTICE IN FOOD MANUFACTURE

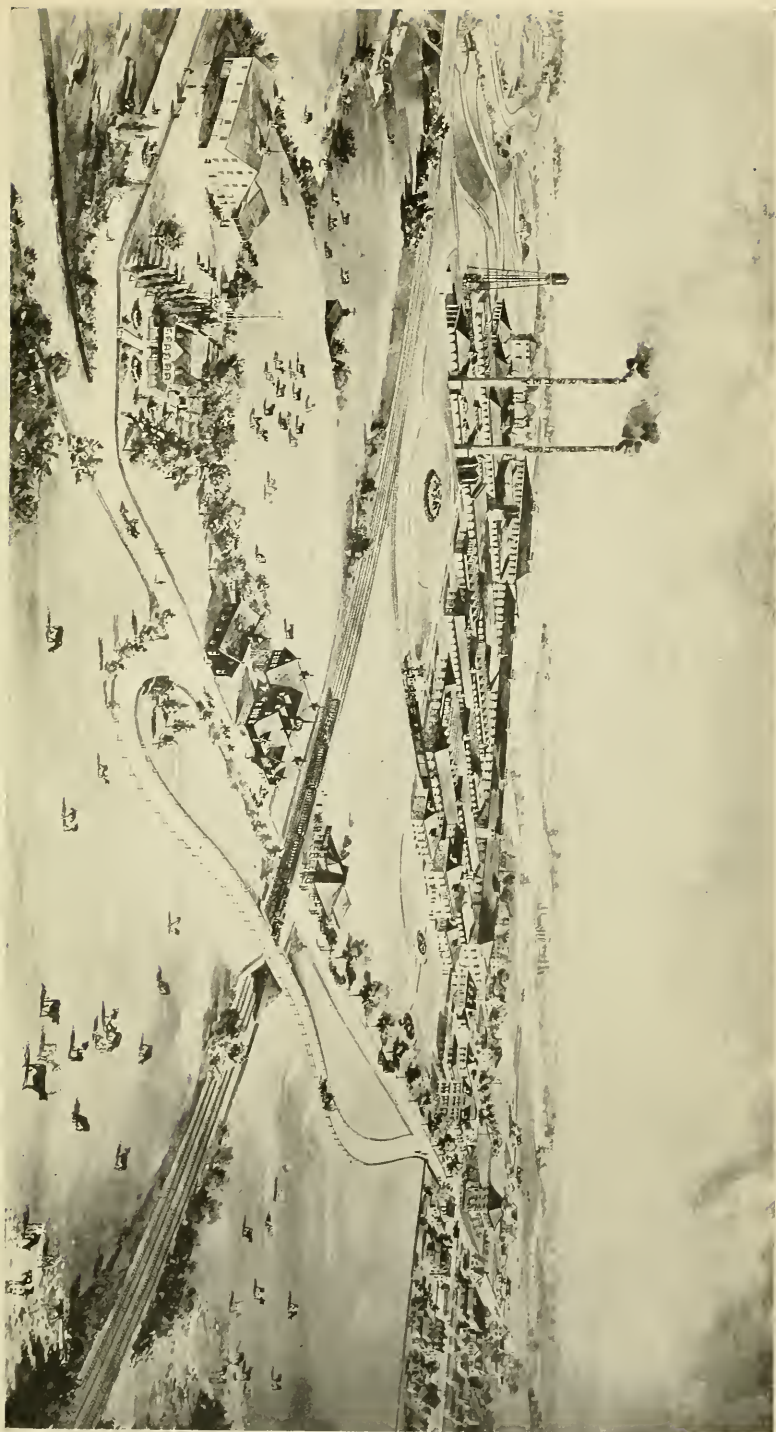
IT would be of great interest to take up all lines of manufactured food and give the hygiene of the matter in detail, but we do not have the space.

On account of the fact that it presents so many sanitary features, the manufacture of cocoa products will be described. A mere academic discussion would be of slight interest, and so the editor of this book made a trip to Hershey, Pa., the home of the largest cocoa factory in the world. The bird's-eye view accompanying this article shows the main works and the nearest dairy farm. As a matter of fact, the extent of the dairy farms connected with the works cover nearly a township.

It is not our purpose to discuss the commercial features of the business, but some points are of interest. There are eighteen thousand quarts of milk delivered daily, and it is an immense task to secure a steady supply of milk of proper quality. Milk that is the least bit defective ruins the flavor of chocolate and that used is nearly all produced by Holstein cattle and must show not less than three and eighty-five hundredths per cent butter fat by Babcock test. All of the cattle are regularly inspected and tuberculin tested and certain specifications for an approved stable are enforced that are far in advance of what is ordinarily found in a dairy farm, and that, I judge, must be quite expensive. We regret that we cannot illustrate the processes used in handling this milk, because of technicalities. However, the scientific side may be expressed in saying that the milk is cooled and centrifuged in a special high speed separator that is not meant (as in ordinary separation) to remove the cream, but is to remove all possible impurities. Even normal bacteria are partially removed.

The milk is pasteurized and run through large aërotors and is concentrated in a wet process vacuum pan to about fourteen per cent of its original volume. This condensed milk is sterile and is at once combined with the warm mass of cocoa and worked for hours in a machine that is practically a mortar and pestle, working several hundred pounds at a time. I saw forty-two such machines going at once, not all of them combining condensed milk with the chocolate, as prolonged grinding is necessary to make a smooth admixture of cocoa and granulated sugar. Some machines are used for the latter purpose.

The superintendent of the department told me that few people have any idea what an erratic fluid milk is, and that a single can of defective (especially ropy) milk will ruin large batches of the manufactured cocoa, and that the factory has more trouble with the milk than with anything else. After much experimentation, they have found that the only way they can do is to practically police a large area, removing noxious weeds, preventing stream



A SANITARY FACTORY, TOWN, AND WORKS. HERSHEY CHOCOLATE COMPANY

contamination, and constantly watching for mould and stable contamination. The cattle are fed by approved formulæ, and the one point emphasized above everything else is that milk of the quality needed in cocoa products cannot be produced except in the open country and with cattle supplied with an abundance of fresh air. Every can used in this factory is tested, and the cans treated with live steam after they are emptied. Very uncomplimentary remarks were made about the ignorant class of farmers and how it takes constant supervision and fines to compel people paid to do it to properly handle milk. My own conclusions, after tramping over the fields to some of the dairies, was that if the Hershey Chocolate Company gets pure milk only under ideal conditions and eternal vigilance, what sort of product do the most of the people get under average conditions? Then, I saw a "Russian Jew" dairy on my way home. "Comparisons are odious." So with the Jewish dairy.

The next problem is the handling of the cocoa bean itself. This firm tells me there is no secret in the making of cocoa products, but that there is very great difficulty in keeping the factory and the product clean. The processes through which it goes remind me of a paint factory, and any one who has made chocolate fudge can realize that the mixture is a sticky, messy, and greasy paint, requiring a lot of dish washing after making. Now suppose about sixty tons of hot fudge were being worked at once, and you have some idea of the matter. Nevertheless, few indeed are the kitchens that can compare in cleanliness with this edible paint works. Although the process requires the heating of the mills and the humid air reeks with the odors of sugar and cocoa, I failed to find even one fly and it was "fly time." Naturally the lack of brown spots over the interior is due to sanitary construction of buildings and machinery and the skill of the men who learn to work neatly. If the case were otherwise, I know of no other products except paint and stove polish that would so soon foul a factory. These remarks apply to the portion of the mills doing the heavy work with the raw materials. Other parts are similar to many factories employing young women, only eating so much chocolate makes them more plump than are most factory girls. Doubtless the fact that the works are situated "all outdoors" and flooded with light tends to produce the same result. I could find no dark place in the establishment except the six hundred feet of tunnel carrying the sewers, pipes of various kinds, and air shafts to carry off impure air by a fan system.

It may interest a physician to read something of the processes employed in the working of cocoa. The cleaned and selected beans are roasted by an open fire and the husks carefully winnowed and rejected. The roasted bean goes through a machine which removes the eye, an insoluble, indigestible, and rather disagreeable portion of the bean. The end result is what is known in trade as "Nibs," which then go to a mill of burr stones similar to that used in grinding grain, but the grist comes out a pasty and oily mass known as bitter or liquor chocolate and consisting of forty-eight per cent cocoa butter and fifty-two per cent "cocoa." This bitter chocolate can be combined with sugar, and the chocolate cakes of the grocery store result; or,

the cocoa butter be removed and the powdered cocoa be ground with sugar and condensed milk, to make "milk chocolate" in cakes or in mould. Omitting the condensed milk results in the cocoa that is packed in tins and is the powdered cocoa of commerce. The powder is bolted. No account is taken of alkaloidal content, but a great deal of care is given to refining the product by processes not necessary to describe, but meant to preserve or improve the flavor. No preservatives except granulated sugar enter into the composition, but vanilla is used to a slight extent in some grades.

This tells it simply in the rough, but a host of little details must be carried out. "Refining" seems to be a laborious process and a vast deal of experience and investigation is essential in the proper blending of the materials. Cocoa is similar to coffee in containing an alkaloid and aromatic substances developed by roasting. No one really understands the chemistry of either coffee or cocoa roasting, and but little help can be given by the chemist in determining what to do when a batch "goes wrong" as, from some unexplained cause, occasionally will occur. There is a wide variation in cocoa beans, and there is a grading in value and price that an expert understands. Quite aside from this visit to Hershey, I have seen cocoa graded and confess that I cannot see the difference between near grades. Widely separated grades are readily recognized by any one. An important matter I noted, especially emphasized at Hershey, was the removal of the eyes. The germs or eyes of all legumes are considered unhealthy by some persons and the Hershey people do well to remove them from cocoa. Some other makers do the same, but not all of them.

It is some indication of the amount of cocoa products used when the twenty-three buildings of this one plant roof over six acres, have engines generating twenty-four hundred horsepower, and employs six hundred and fifty people, exclusive of those in the numerous dairies. In the printing department I noted that one of the embossing machines turned out three hundred thousand labels a day. To me it is very encouraging to see that this factory is one of several large ones right in the open country. This tendency should be encouraged. The city problem will soon be solved when we get many large industrial centers in the rural districts. As related to food products, it will guarantee much more healthy workers, cleanliness, and higher quality.

The welfare work of this firm is remarkable, in view of the fact that it is giving city pleasures to the whole countryside within reach, and is entirely free to every one who preserves good order. This work includes the maintenance of a large park, with golf links, ball field, dancing pavilion, lecture hall and free lectures, free theater, costing the management about two hundred dollars per week, savings bank, and other free features.

The works has its own trolley line, hotel, bowling alley, shooting gallery, and store. These features are not free, but offer city conveniences to the country and make a contented neighborhood. This little village has sewers, electric light, and the other accommodations of the works. Pneumatic cleaning is one of the little things showing the horror of dust one finds expressed there in numerous ways. The attitude of the factory toward pure



WELFARE WORK

ROOF GARDEN AND NATATORIUM FOR EMPLOYEES, H. J. HEINZ CO.

food laws rather amused me. They were neither informed nor interested therein. The Scotch superintendent explained that they were doing the best they knew how, and that laws could not make them do any better, and he thought it a hard task to keep up with the changing maze of laws ground out by legislatures.

Pickles and preserves.—To see forty-five thousand quarts of blackberries being made up into jellies, etc., and carloads of cucumbers, tomatoes, and other fruits and vegetables galore ground through the machinery and processes of a big pure food factory occupying a score of large buildings, makes one dream pickles and jams and (if the truth must be told, also “dream of fair women”) for days afterwards. The first impression one gets in the Heinz company’s workrooms are of a diet kitchen in a hospital, with a host of pretty nurses making dainties for the sick. Here is a food factory in a big city, but at the river’s edge and backed by hills, and so it is hygienic, after all. A detailed description is not necessary, because the hospital standard of cleanliness and hygiene is everywhere apparent. A physician can readily see how that would work out with “fifty-seven different kinds.” “Surgical cleanliness” means a whole volume to a doctor, and that comes near to describing this establishment.

The present writer has visited other food factories and has seen excellent conditions in many of them, but this is the largest one I have seen, and it is spoken of for two reasons: first, it is living up to both the letter and the spirit of pure food legislation; second, the management take a reasonable interest in the scientific side of the work, and has helped me to answer a series of questions of interest in this chapter. Condensing them somewhat, my questions were as follows:

(a) How much of a factor is bacterial contamination of fruit and vegetables in transit to the factory and, again, in the processes of manufacture?

(b) Is it true that aldehydes form in canned fruits without rupture of the cans?

(c) Is it absolutely necessary to add a preservative to canned corn and tomatoes; or, in other words, are these two vegetables harder to preserve than are others?

(d) Is any degree of fermentation liable to occur with fruit in cans or jars, and not be detected?

(e) How long will Heinz ketchup keep after being opened and is it necessary to place it in a refrigerator?

(f) Is it necessary to add chemical preservatives to ketchup?

(g) When rejected portions of fruit are worked up into cheap grades of products, is it always necessary to add thereto a chemical preservative?

To these questions the Heinz Company made reply, expressing, from the commercial side, quite as positive views upon the use of food preservatives as have the scientists from the laboratory side of the question. From their letter and my observation of processes, the following answers are derived, but they should not be taken as specifically representing the point of view of the Heinz Company.

(a) If the fruits or vegetables are whole, ripe, and sound, and are handled properly in shipping, there is not very much chance of bacterial contamination. Delays beyond a certain point from the time fruits and vegetables are harvested until they enter into the manufacturing process are dangerous; but this danger may of course be avoided by a rigid inspection of all raw material. This, however, means work where the shipping delays have occurred, or fruit is purchased in the open market and a loss which the unscrupulous manufacturer is rather loath to incur

Bacterial contamination may occur after a product has been manufactured, if the manufacturing establishment is not kept in a clean and sanitary condition. This could come about by allowing a cooked product to be unnecessarily exposed to the atmosphere for a length of time while cooling off before filling it into its final containers; by unhygienic conditions in the immediate vicinity of its cooking and handling; by carelessly cleaning cooking vessels and implements; and by the use of dirty or unsterilized bottles, tins, or crocks. Where proper conditions exist, however, in a food manufacturing plant, there is no more likelihood of meeting with bacterial contamination than there would be under ordinary domestic preparation of similar products in the best home practice, in fact, less than in domestic practice, because the commercially made product must be shipped to all parts of the world and undergo extreme climatic changes; and the best, higher class, commercially manufactured products are made with a degree of care that insures the successful handling of goods in this manner.

(b) We have no knowledge of the matter that justifies an answer to this question. However, I believe it to be possible if fruit is kept for two or three years.

(c) They do not believe that any packer of fruit and vegetable products in cans will claim that an artificial preservative in this connection is a necessity. They tell me that all canned goods can be successfully kept if put up under reasonably decent conditions by sterilization after sealing.

(d) Fermentation in fruits is very rare if cans and jars have been properly treated, and when it does occur experience teaches that it can easily be detected, even if it has progressed only a short time, by the bulging of the cans or the breaking of the glass containers.

(e) It is not necessary to keep non-preservative ketchup on ice after a bottle containing it has been opened. It will keep under ordinary conditions of house temperature from four to eight weeks, according to the surrounding conditions. Refrigeration is of little value for the preservation of tomato condimental products.

(f) No.

(g) When good fruit is being prepared for canning, rejected portions of it can be preserved without an artificial preservative, if it is handled quickly and in a cleanly manner. This would apply, for instance, to skins and cores of apples being prepared for evaporation, or the skins and cores of tomatoes being prepared for canning. The trouble with such waste material is usually its careless handling and the delay that occurs in putting it up, during which time it becomes filled with bacteria, spores, and mould.

This waste material requires very much more sterilization than good material to keep at all without a preservative; but when it has gotten into the condition mentioned



FILLING TINS OF BEANS

STERILIZING FILLED TINS OF FRUIT

KETCHUP KETTLES

above, without a preservative, and if flavored and spiced only to the extent employed in the use of good raw material to make a tolerable article, it requires still more sterilization under long and a high degree of heat, which when applied makes it unsightly and not fit for food. Thus the lack of disposition to properly handle these bi-products of fruit and vegetables causes the persistent demand for the legalizing of an efficient antiseptic substance which will be both tasteless and odorless.

In sterilizing the product of good raw material, properly handled, not a very high degree of temperature is needed, and the flavor, color, and structure of the fruit and vegetables can be retained.

In order that such excessive heat as described may not become necessary in the sterilization of products made from unsound raw material, it is necessary either to use an artificial preservative, or to spice and otherwise season a product so as to absolutely conceal the individuality of the raw material, thus making it merely a carrying agent for the flavoring and substance employed.

This is, however, contrary to the contention of some of the pro-preservative people, who claim just the opposite — that the non-preservative manufacturer uses an excess of the natural condimental preservatives to the extent that he kills the natural flavor of his fruit and vegetables. That this is untrue can easily be determined by tasting the pure products; but it is only the specious arguments constantly being put forth which seem to appeal to some unthinking people and to some law makers, and those charged with the administration of laws in some states, who seem to be looking for some means by which some of the old fraudulent practices in food manufacture can be perpetuated.

CHAPTER XXII

PUBLIC WORKS AND CORPORATIONS*

Section I

The nature of the sanitary laws regulating corporations—Corporation surgeons — Their limitations as to state registration and extra-territorial practice — Some remarks upon medical practice acts.

Water and filtration systems for municipalities.

Public lighting plants.

Oil pipe lines and oil works — Oil regulations.

Sewage disposal plants.

Mine dangers and their prevention — Care of miners.

Factories, workshops, and various industries; their hygiene, perils, inspection, and regulation in detail.

Minor public works.

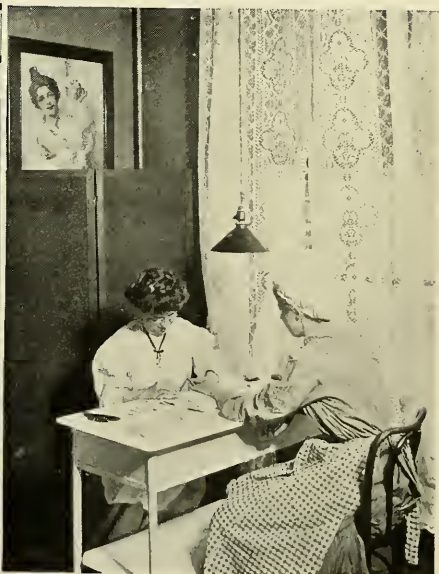
BROUGHT face to face with the problem of work, and a very ugly problem it is in the rough, man planned to avoid it as much as possible. He tamed, fed, tended, and bred the animal, drank its milk and ate its flesh, and above all he taught it to do the heavy and unstimulating part of his work.

But the animal is not intelligent enough to do this alone, so man wherever possible caught other men and forced them to do his work for him, reducing a part of his own species to the grade of animals. And, along with this, he gradually got control of the blind forces of nature, the winds and water streams, and steam and electricity, and he made machines to be moved by these forces, which, when he had once set them going, could even do work which his hand and eye were not good enough to do. So while he reduced a portion of the human world to the animal status, he raised a part of the inorganic world to a quasi-human status. A machine is an arrangement of materials and forces without a mind, but which works as though it had a mind.

Now it is to be observed that all this clever work of the mind of man implies looking backward and forward, comparison and calculation. Human supremacy is due to this indirect quality of mind. The other animals leave the world as they found it; man reconstructs it. The mind is quick to remedy intolerable and painful conditions, but to look a long way ahead and prevent their occurrence is not easy, and indeed not natural. In fact, man could not possibly calculate to prevent bad conditions until they had occurred and he had felt the painful consequences. Very certainly one of the greatest stimulations to looking ahead has been periodic shortage in food and the recurrence of famines. This led to economy, thrift, and systematic labor. The domestication of the animal, the use of its milk, harnessing it to the plow, and putting off on it and the women as much of the particularly disagreeable task of cultivating the ground as possible, the capture of other men to do his work for him,

*By several contributors who supplied data and reprints for the author to edit, or who wrote sections entire.

NOTE.—The next chapter is closely allied to this one, and the two chapters practically constitute a unit. What is presented in both of them was procured from the most authentic sources, but, naturally, some gentlemen who gave data prefer not to be quoted because of their official positions and the ethics involved.



HARVESTING TOMATOES

CANNING PORK AND BEANS

THE FINGERS MUST BE MANICURED

the use of so unpromising creatures as the little bee and the silkworm to provide for his comfort, and the later resort to machines, to child labor, to capitalistic manipulation and industrial slavery, are inventions through which man helped himself out of disagreeable situations.

W. I. THOMAS

The nature of the sanitary laws.— Law is directed primarily to the control of the individual in conserving the rights of the many. "The people" means the state or the government in degrees varying with the enlightenment and humanitarianism of the state. The principle of "the greatest good to the greatest number" still holds, but is not all-inclusive, since we have come to know that "the welfare of the individual is the welfare of the state." Class legislation is still opposed, but the general rights of individuals are conserved by arranging laws recognizing certain class privileges exercised jointly for the benefit of the individuals forming the class. The law may not establish funds for the care of one blind man, but it may set aside public moneys for the care of the blind.

The law will not allow one man to obstruct the roadway in front of his house, but if the majority or a large number of men using that roadway wish a useful obstruction, in the form of a steel track, to be placed the entire length of the roadway, the courts may grant that privilege provided the many men come before the court as *one*, or, in the form of a partnership known as a corporation. The laws permit many men to peacefully band together to do what one man cannot do, but the laws also exact of the corporation that these many men obey the state and perform their duties just as the law exacts of the individual. Hence, the laws regulating corporations are a mere expansion of the laws controlling individuals. Most of the laws incumbent upon the individual are not what is known as general law, but are acts of assembly or specific ordinance. So with the corporation, specific legislation is necessary or inclusive phrases in the wording of a general act or ordinance. That corporations seem to be more privileged to do as they please than are persons not incorporated is not the fault of the courts, but is due to a lack of specific legislation or ordinance or regulation. It is not the purpose to confer immunities upon them, but the immunity may exist in the absence of legislation, or the legislator refusing, rightly or wrongly, to enact the restraining laws. Public health legislation is no exception to the general rule, and inclusive phrases may be inserted in any health law making it applicable to the corporation. Also, the nature of the work undertaken by corporations may make especial provision necessary. Private drivers of horses and automobiles may be confined to a certain rate of speed; so may public vehicles, such as railway trains or trolley cars. Disinfection may be demanded of the individual and so it may of the corporation. But unusual or drastic legislation may not be demanded to apply to the corporation and not to the individual. Cities may establish what is known as fire limits, and require all buildings within the specified bounds to be of brick or other approved construction, but the city cannot permit an individual to build wooden houses

beyond these limits and require a corporation to build of brick, unless it be some especial *class* of structure otherwise provided for.

Corporations bear a large part of state taxation and are responsible to their stockholders, and it is no more fair to unduly restrict them by law than it is to restrict other business enterprises. On the other hand, the laws are made for the corporation just as much as they are for others, and corporate greed must be restrained just as rigidly as is individual greed. We have seen grow up into prominence the "corporation lawyer." Some of these gentlemen would like to have a corporation court. There is equal reason for a labor union lawyer and a labor union court. But American ideas are outraged by either one of these, and we feel that the modern legal training to invent subterfuge and delay places the courts in the position of serving the interests of the party having the most money. Ex-President Roosevelt and others have waged a strenuous warfare to end this sort of thing, and the publicity incident thereto has made apparent that the *best* corporations do not favor evading the law, and their example is having a good influence upon *all* corporations. This matter is dwelt upon for the reason that if corporations are immune to law in general, they would soon pay no heed to the sanitary laws.

It seems to me that this little argument makes it apparent that there need be no discussion of sanitary law from the corporation point of view or from the alien point of view or from that of the citizen. All are as *one* when it comes to sanitary and most other laws, and we are all bound to obey them.

It is undoubtedly true that a railroad may justly be annoyed when one state requires "Jim Crow" cars upon a train running a few miles into that state and many miles through a state having no such regulation. One state prohibits this, that, and yon, and right over the border the list of prohibited things is different. There is a railroad starting from Harrisburg and running south one hundred and sixteen miles, and traversing four states in that distance. It is very difficult for it to observe all requirements. However, when the writer registered as a physician, his papers gave him license in one county, and his practice took him occasionally into four counties, each requiring registration. The matter is less rigid now, and that of which the railroads complain will be worked out in time.

Corporation surgeons.—Objection has been made to the term "corporation lawyer." The same reasoning applies to this title. One soon learns just what surgeons will appear in court for the corporation involved in a suit for damages, in some *localities*. A little coterie of professional men seem to be the standing committee of "experts" and one always knows how they will testify. There are thousands of honorable professional gentlemen holding appointments as surgeons to railroads and manufacturing plants who would scorn to go upon the stand and testify in any warped manner. As a rule these men do not like to appear in the case. They are interested only in their professional work for the persons injured by the trains or machinery, and they give their services to the railroad for a proper remuneration, and do not concern themselves with the legal aspect of the cases they treat. They do not pose as lawyers or as claim adjusters. The surgeon who enters

the presence of the injured person, like a police officer, and makes elaborate inquiries about liabilities and contributory negligence, and smells the breath of the patient and insists that he be taken past two or three good hospitals to some favored one two miles away,—this man is beneath contempt. Yet he is a celebrated “expert.” He is a fit companion to the rank class of “corporation lawyer,” and they usually divide the spoil.

What is said in the last paragraph is not to be taken as derogatory of the honorable lawyer or surgeon employed by a corporation to perform for it the functions proper to the activities of legitimate law or surgery. To employ either man to secure thereby especial immunities or unusual privileges cannot be defended by honest business principles or by professional ethics.

A lawyer may properly confine his work to corporation law or to criminal law or to divorce law, but the words “corporation lawyer” sound just as bad as does “criminal lawyer” or “divorce lawyer.” A physician may be a coroner, and specialize in medical jurisprudence; or a health officer, and specialize in sanitation, but that does not conceal the fact that he is *first of all a physician* and is bound to certain lines of proper professional conduct. The fact that he is employed by a county or a state does not absolve him from his obligations to his profession and to the individual. Neither does the fact that a lawyer is employed by a corporation free him from the fact that he is an officer of the court and from his oath to uphold the laws and support the constitution.

There is a vast deal of loose talk about corporations, and a needless prejudice against the lawyer and the surgeon serving corporations. As a class, they are not guilty of irregularities. Corporations should be encouraged to employ surgeons. One corporation has gone so far as to undertake the payment of necessary medical and surgical care for their employees and those dependent upon them, and the employees are at liberty to select any physician who is considered reputable. The corporation takes the ground that it is a good business policy to relieve their men of worries incident to illness.

Their limitations as to state registration and extra-territorial practice.—Probably this subdivision and the next following one might afford an opportunity to dilate upon how badly the medical profession is said to be treated in the United States. One reads so many articles in the medical journals commiserating the profession that we are wholly saved that task, and it fairly makes one dizzy to first read the complaints of the physicians who denounce all forms of boards, political activity, and medical legislation; and then read The American Medical Association Bulletin for March 15, 1909. This latter publication gives the impression that even more legislation is vitally necessary to save the profession from many kinds of ills. We take the liberty of reproducing from this pamphlet the following historical data.

A survey of medical practice legislation in the United States from an historical point of view, reveals some interesting facts, which can only be touched upon in this report. Previous to the Revolutionary War most of the colonies, at that time crown dependencies to Great Britain, passed some restrictive regulations generally providing

for the examination and licensing of new members to the medical profession by the profession itself, which at that time consisted of but a single school, and was in most cases recognized as being competent to examine and license applicants for admission to its membership. The remains of this period of legislation are found in such organization as the Medical and Chirurgical Faculty of Maryland, the Rhode Island State Medical Society, and the provisions existing in New York prior to 1870, by which any county society had the right to examine and license physicians. This was followed by a period, beginning shortly after the Revolutionary War and extending to about 1850, and marked by the organization and development of a large number of medical colleges in the new states. During this period, a diploma was recognized as equivalent to a license, and in many states was all that was required. The rise of the homeopathic and eclectic schools during this period, and the establishment of medical colleges by them led to the repeal of the laws in many of the states, and the recognition of a diploma from any educational institution as a qualification for practice.

The organization of the American Medical Association in 1847, primarily for the purpose of regulating and raising the standard of medical education, marked the beginning of the third era of medical legislation. One of the principles most strenuously advocated by Dr. N. S. Davis and his colleagues was the separation of the licensing power and the educating body and the establishment of state boards which should examine the applicant without reference to his college qualifications and license him only in case he was found properly qualified. This plan, earnestly advocated from 1850 to 1870, has resulted in the general establishment of state licensing boards and the abolition of the recognition of a diploma as conferring the right to practice medicine. To-day every state has some form of examining board recognized as a state board, and in only a handful of states is a diploma issued by a medical college accepted in place of an examination. So firmly established has the state board and the compulsory examination become that this feature has been taken up by osteopaths, optometrists, chiropractics, neuropathics, and a host of other faddists and sectarians who have demanded of state legislatures the establishment of similar boards and the right of "protection" from incompetent followers of their own beliefs. This almost unlimited expansion of the licensing plan, coupled with the fact that the enforcement of the law in many states has not given the results hoped for, and with the lack of public support of the law in many states, has awakened doubt in the minds of some as to whether this is the best method of regulating the practice of medicine. This is a fundamental question which must be considered seriously before any attempt is made to unify our state medical practice acts.

The last sentence quoted may well give pause to the gentlemen who are so ardently pushing legislation. As a general practitioner, and yet as one who has taken a small part in medical legislation, it impresses me that a mistake is being made by leaving this question almost wholly with committees of enthusiastic gentlemen. The only way to receive the attention of legislatures is for a united profession to first decide *what they want* and then proceed, by proper legal methods, to get it. It will take *the whole profession* to determine the first question, and only the latter one belongs to committees. The churches give a good object lesson in this regard. Some matter of church policy or discipline comes up in their national conference or general assembly or other national body. It is well threshed out and a series of questions is drawn up, as suggested by the discussion. These questions are propounded to the lesser bodies all over the country and discussed by them and voted upon. The

next annual meeting of the national body has before it the expressed views of the whole church upon the matters at issue. The same plan should work well with medical societies. There is a great deal of ink unnecessarily shed in the battle over legislation, and certainly none of the legislation will be very satisfactory until it is intelligently determined what the profession *wants*.

And the next question is — What does the public want? There is a tendency to express the view that the public don't care, is ignorant, runs after fads and cults, prefers the quack to the well-qualified man, and likes to stab the doctor in the back when it gets a chance. Now I don't believe anything of the sort. We doctors have just as great a capacity for making fools of ourselves as have lawyers, preachers, merchants, clerks, and the rest of the cosmos called "the public." We are not always right, and the public know that very well, and are unwilling to consider us as a privileged class set to the task of regulating everything.

The whole attitude of the public is expressed in the phrase — "show me." If we *do* show a thing certainly, and as necessary to do, the public listens and heeds. Take the present anti-tuberculosis crusade as an instance of this. The public has a very poor opinion of the present medical legislation. It is certainly true that legislation has elevated standards and worked some reforms, yet it seems to many men that the present politically appointed examining boards constitute a mere temporary expedient, and that some better way will be devised in time. If a better way is *not* devised, some reasonable modification of the present plan is necessary. This latter will probably be the outcome. Mere politicians are being weeded out of the examining boards, reciprocity is being extended and demanded everywhere, and a more reasonable view generally is prevailing. If the fruits of better medical laws are good, the public will do its share in upholding them, but some tangible results must first be shown. It complicates matters very much to have two sets of state medical officers, and the plan of Illinois of putting the licensure of physicians into the hands of the state board of health impresses me as a very good one.

A little elementary thinking upon the Constitution of the United States, and the nature of the state government and their rights under the federal and state constitutions will make many of the contentions of medical men look very foolish. The licensure of physicians is *purely a function of the state*, and the same difficulty exists as is found with pure food and drug legislation. The best that we can expect is more uniformity in state legislation and the extension of reciprocity. Were it possible to secure it, it is very doubtful if a national license would protect the public and the profession as well as does state registration. It is said to be only a partial success in Germany, a country covering much less territory than does the United States.

These general considerations answer the questions as to the registration of corporation employees, be they engineers, plumbers, surgeons, or any other class of men regulated by state laws. The country is big, and various rules prevail in different parts of it, but it is not safe for a surgeon to presume that he is immune to state regulations because he is doing work for a corporation doing an interstate business. As a matter of fact, if a physician

has complied with the law of one state as to registration, and makes his office in that state, very few neighboring states are apt to interfere with him if he is called across the line to see occasional cases. If he opens an office in the state, he must be licensed there, but the work of a surgeon in attending an injured person is not interfered with upon a mere technicality. However, if the surgeon is very frequently called into the state other than his place of residence, it is well for him to communicate with the proper officers and be assured of his ground.

Medical practice acts are found in nearly all of the states. It is not our purpose to discuss them in detail here. The American Medical Association issues a pamphlet upon the matter and keeps it up to date. Those desiring data should procure it or send to the state concerning which they are interested. The present writer has examined the laws of a score of states, and so many questions are raised by such a study that he realizes how impossible it is to do justice to the subject in our present discussion of the matter in its relations to public hygiene. A few points seem clear. First, medical registration is necessary; second, it being necessary, physicians should not object to reasonable requirements even if inconvenient to them; third, the matter should be absolutely divorced from politics and should be directly connected with the administration of other matters connected with public health; fourth, reciprocity should be generous, and old practitioners should not be oppressed.

The American Federation of Reciprocating, Examining, and Licensing Medical Boards is studying the question, and what they have to say is interesting. Dr. Jas. A. Egan, secretary of the Illinois State Board of Health, has published some pamphlets giving some of the difficulties from the point of view of the authorities. Any fair study of the matter involves reading both sides, and there is much to be said upon both sides.

Probably the rank and file of the profession feel that legislation is not a cure-all, and attach less importance to it than do the men who are allied to such work. A middle ground is safest in most things, and a little less enthusiasm in making laws until we know what we really want, and the public needs, will advance the matter more truly than will the present hit and miss methods.

This matter of professional standards and licensure belongs to the broad domain of public health administration, and it seemed to fit in better here than to give it separate and detailed consideration in a chapter of its own, and which would be hardly justified, in view of the large amount of literature available and written from the standpoint of the general practitioner.

Leaving this subject, we will abruptly take up the large and important question of public water supply. In the chapter upon "Rural Hygiene," an introduction to the subject will be found in the consideration of watersheds and rural water supply. Also, in Chapter XX, the allied subject of plumbing relates to the matter, and it is further discussed (under specifications for public buildings) in Chapter II. This present chapter will take up municipal or public water supply.

Section II

WATER AND FILTRATION SYSTEMS

WATER supply and its purification has been touched upon in so many portions of this book that it does not impress the editor that we need here discuss general principles so much as those matters of interest to a municipality in establishing and maintaining a public water supply. Our present limits will not permit even of a survey of the many engineering and chemical factors involved. Indeed, so large is the problem that nothing short of a whole volume can give the reader any adequate understanding of the difficulties facing the city seeking a pure water supply. With all due deference to the many gentlemen who have covered the matter in a chapter of a volume upon hygiene, I beg to say that they have not conveyed any apprehension of the real difficulties besetting a public water plant, and that vary from month to month, and for many of which there is as yet no real remedy.

My own visits to varied sorts of plants have made me very skeptical as to the supply of practically all of the large cities upon the Atlantic seaboard and many interior ones. Many physicians imagine that engineers are agreed upon practically all of the problems embraced in water supply. As a matter of fact, there is considerable disagreement among them. In my own reading of books and city reports I have seen reflected the views of different engineers, and could almost tell what engineer made the plans for any plant in question, simply by reading the reports concerning it.

In the chapter upon rural hygiene, considerable space is given to a discussion of watersheds. While I wish to reaffirm every word there said, I am positively of the opinion that to rely wholly upon a well-managed watershed in any populous state to supply safe water is bad policy and dangerous. Probably nowhere else is a watershed so well policed as is the one supplying New York city, and yet the typhoid rate there is almost constantly higher than it should be. The department of health of that city is probably not excelled anywhere, and is doing all it can, but it does not stand to reason that so large an area can be kept constantly clear of enteric bacilli and organic impurities. Every city should filter its water, despite its care of the watershed. Both factors are necessary to a good supply of water.

Despite the proper agitation against polluting our rivers and smaller streams, they are now and probably always will be polluted in a thousand ways. One cannot crowd the country with people and expect the streams to remain clean. Factory wastes and sewage may be kept out, but what of the surface drainage from millions of acres of cultivated land?

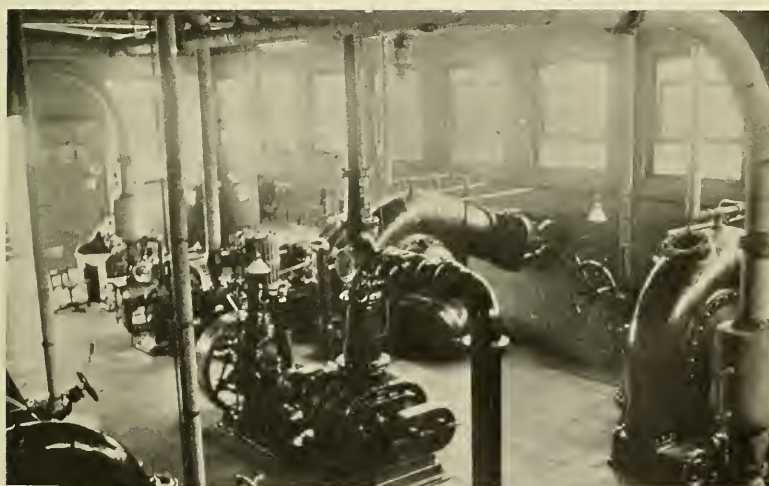
The mechanical part of the work of erecting a water plant is one for each locality to determine after consultation with gentlemen who are *consulting* engineers, and are not employed by some manufacturing firm. There are many good pumping engines upon the market, but none of them will bear the constant load if pushed. It is well to remember that water positively cannot be compressed and the pump is constantly working against a dead load. Never put in a three million gallon per day pump and expect it to pump that

much *every* day. It is safer and costs less in up-keep to erect a five million gallon installation when the consumption is three million gallons. Duplicate installation is advised for large cities in which a breakdown of machinery is in the nature of a calamity. It can be generally said that the triple expansion engine pays for a water plant, as these engines need not run at a high speed. It is certainly well to have a reservoir where proper elevation can be secured. Pumping directly into the mains requires heavy piping because every throb of the engine imposes a strain. This may be somewhat overcome by erecting a strong water tower and pumping directly into it. When the reservoir is at some distance from the pumping plant a tower may be of use to relieve the tension upon the line to the reservoir. Any good work upon the subject will give a host of points as to the substantial and sanitary construction of reservoirs, and for which we do not have space here. But permit one word of advice from one who does not pose as an engineer, but has been much identified with construction. Concrete is very largely used now in waterworks construction and many persons think that concrete can be mixed by prescription. The matter is not half so simple as that, and every concreting job should be under the eye of an experienced man. The theory that soft stone makes good concrete is all nonsense. A reservoir at an excessive elevation imposes too great a strain upon every valve and pipe supplied by the system, and there is nothing to gain by it. Electrolysis does great damage to water pipes. Every municipality should require electric traction lines to bond their rails well and to refrain from packing wet soil about the rails.

Political supervision of a waterworks usually shows upon the wrong side of the ledger. It pays to employ a good engineer and keep him as long as he will stay. Selling water by meter saves to the municipality.

All municipal water supplies should be filtered. The large municipal filter operates upon the same principle as does the smaller ones described in the chapter upon army and navy hygiene, and dwelt upon in several other portions of this book. Contrary to many other mechanical propositions, the large filter does not necessarily do better work than does the small one. It is undoubtedly the fact that the slow sand filtration gives a very pure effluent so far as suspended matters are involved *if the filter is properly constructed and operated*.

Municipalities that expect to attain the same high efficiency in filtration that is reported from the Lawrence experiment station are apt to be grievously disappointed. The filters there are operated under scientific supervision hard to procure and maintain in most cities. In Europe they get excellent results from slow sand filtration, but we Americans are too much in a hurry, and we push the filters too hard and employ cheap labor to do the rough work. Neither one of these economies pay if we value public health. It is a mere matter of fact that most of our large municipal filters *do not* come up to expectation, and the effluent contains altogether too many bacteria. This is not the fault of the process but of the men operating the filters, or of the authorities who make insufficient appropriations to properly maintain the plants. A properly constructed slow sand filter plant is very expensive to



VIEWS OF HARRISBURG MUNICIPAL FILTRATION PLANT

build and to maintain, and it takes good men to get proper results. But what of that? It surely does reduce the enteric diseases directly in proportion to its efficiency.

Mechanical filtration also is a good process, but involves even more careful supervision and daily analyses of the water to determine the proper amount of coagulant chemical. Beside all that, defiled water is a complex proposition, and even a good chemist is often at his wits' end to know what to do under the many conditions confronting a filtration plant. From inspection of several mechanical filtration plants, I am inclined to the view that the reduced cost makes it a very excellent process for cities limited in resource, or where there is a very muddy water to filter, and that is not contaminated too largely with bacteria and organic matter. Owing to the slimy pellicle of nitrifying bacteria forming upon the surface of a slow sand filter, that process of intermittent sand filtration will probably remove organic impurities in solution better than will the mechanical filter.

Sometimes a very impure water is the better handled by first submitting it to the mechanical process with a coagulant, and passing the effluent through a slow sand filter. Ozone is employed more or less, and will be considered in a special section. The opinions here expressed may not be concurred in by all, but are based upon very careful personal investigation.

In all municipal work it must always be remembered that local conditions are a very large factor, and standard specifications for water and filtration plants may not be at all adapted to conditions. Where the site is cheap and sand is plentiful and accessible the slow sand filter may be within reach of the municipal purse; otherwise it may not be. In a high latitude with long and cold winters, the filter will freeze up unless well covered with concrete arches and sometimes even then. These coverings are very expensive. It is to be hoped that the ozone process will solve some of the difficulties of Northern cities. In the South, the water gets very hot after going through the filter, and being stored in a reservoir and covering may be necessary there. No municipality need fear danger from alum in the water, provided a good chemist is employed to superintend its use.

THE PURIFICATION OF PUBLIC WATER SUPPLIES BY MEANS OF OZONE

In view of the fact that at the present writing Baltimore* is finishing a plant of this character designed to purify ten million gallons a day, and that Ann Arbor, Michigan, is just about to start the operation of a plant handling one third as much, the editor decided to forego previous prejudice against the method and look into the matter for the guidance of those who may be interested.

Theoretically, ozone should markedly purify water containing organic matter, but a series of experiments personally undertaken several years ago were so disappointing that I dropped interest therein. I can see now that my difficulty was in the generator.

*The Baltimore plant is one supplying the suburbs, and not the entire city.

Ozone is an allotropic form of oxygen being polymerized by the silent discharge of a high tension electric current. It is a strong oxidizing agent, commences to decompose at 100 C., decomposes certain drugs, such as iodide of potash, transforms ammonia into nitric acid, combines with phosphuretted hydrogen with an emission of light, oxidizes silver, and promptly kills moist bacteria.

In the electrical production of ozone, only the chemical action of the current is sought, and, in recently realizing this, great advance has been made. According to R. M. Leggett, C.E., E.E.

The glow or silent discharge produces very little light and heat, and acts almost exclusively on the oxygen in the air. Its action on nitrogen, even in the presence of moisture, is very feeble compared with the other forms of discharge. The recognition of these features of the silent discharge have brought about important changes in the art of ozone production, as this violet-colored discharge is the only one which will continuously produce ozone with any practical degree of purity.

All physicians are familiar with the production of ozone by means of the induction coil or static machine. Commercially, these methods are of no value, and high tension alternating currents of high periodicity are connected with electrodes having a non-conductive dielectric interposing in what would be otherwise an arc, or, as in the Bridge method, using special electrodes requiring no dielectric. This special electrode is perforated and air passes across the interval from the perforations, and the result of operation is eighty grams of ozone per kilowatt hour or, at average rate for a large generator, one cent's worth of electricity.

It is a very simple matter to incorporate this gas with the water to be purified, but the process does not remove sediment or rough matter in suspension. Hence, the water, when necessary, is first rough filtered. Ordinarily "pre-filtration" costs from fifteen to fifty cents per million gallons, depending upon the character of the water. As to whether waters requiring precipitation with alum or other chemicals can be economically handled, I have no information, but can see no reason why they cannot, provided the sedimentation or settling basin for the alumed water is large enough.

Installation of ozone plants with the ordinary rough filtration appliances costs about one half as much as does the slow sand filters, based upon capacity. Mr. Bridge, the originator of the system most used in America, claims that the ozone process costs about thirty per cent as much to operate as does the slow sand filter. His point of view and data will be found in "The Purification of Public Water Supplies," by James Howard Bridge: The Canadian Engineer, Toronto. In Canada and our northern states it is a difficult problem to operate filters during the winter season, and the Canadian engineers have given the matter much study.

Dr. D. Rivas, of Philadelphia, conducted a series of tests at an experimental plant at 30th and Locust streets, a few years ago, and found that Schuylkill River water containing seven hundred thousand bacteria per cubic centimeter, forty-eight hours after being ozonized, contained as low as

five bacteria per cubic centimeter. In other words, the then diluted sewage, called by courtesy a river, was rendered practically sterile by this process. Fortunately, the Schuylkill has been somewhat improved since then. Foreign experimentation upon the subject has been so extensive as to warrant a host of small ozone plants on the continent, while recent improvements by several investigators have rendered the process sufficiently cheap to warrant several large plants. Much more experimental data is at hand, but space precludes its reproduction here.

As to what happens to water during the ozone process, from several reports I deduce that the bacteria are disintegrated with the evolution of carbonic acid gas, organic matter in solution is oxidized, coloring matter is removed, and the chemical changes depend upon the composition of the water, but are not deleterious in any circumstances. From some considerable examination of the literature it appears to me that suspended matters such as clay and detritus are little influenced by the ozone and should be removed by filtration. In other words, it does not impress me that a muddy water can be rendered satisfactory by the unaided ozone process. But when we consider that the rapid methods of filtration readily remove these suspended matters, but allow many bacteria to pass through, the ozone process grows in importance. In a few rivers there are, however, clay particles too minute to be removed by the rapid method. Sulphur waters are a problem that it is claimed is solved by the ozone process, since the sulphuretted hydrogen is converted into a sulphate. In Florida there is much water of this kind, and the residents there draw it and let it stand over night before using it to drink.

From the engineering point of view I find the authorities vary in opinion, but a superficial view of the plants operating by ozone shows a very small number of workmen and very little space occupied, and certainly the effluent is very clear and excellent water nearly sterile by recorded tests from time to time. What inherent weakness may exist in the process, or what faults may develop in the future is for time alone to tell, but cities contemplating the building of a filtration plant will do well to send committees to Baltimore or Ann Arbor to inspect this comparatively new process.

FILTRATION FROM THE MEDICAL POINT OF VIEW

As nearly as the editor can ascertain the sentiment of to-day, engineers are agreed that skilled attention is necessary to the safe and effective operation of a municipal filtration plant, and that it is not safe to estimate average conditions exactly parallel to those attained at Lawrence and other places where especial skill and care is the rule and not the exception. I have personally seen an experimental filter deliver water absolutely sterile, but that was a very rare exception. Germany has a law forbidding the operation of filters leaving over one hundred bacteria per cubic centimeter in the effluent. Compare this with the published reports of city filtration plants in this country and a bacteriologist is made to shudder. According to actual reports of some of our American cities, as much as thirty-eight hundred bacteria per

cubic centimeter are left in the water and from that down. Now that is fact and not theory, and indicates in no uncertain way that political jobbing in public filtration construction and operation is only another word for conniving at a high death rate from typhoid and other enteric troubles. I could tell some rather startling things about certain municipal filtration figures, but prefer to simply let the reports express the matter.

It is not fair to the eminent engineers and sanitarians who are working so hard upon the matter of water purification to install poor work or leave good plants to the care of any haphazard "expert." Every plant should have a good chemist. Mr. Leggett has well said:

Under normal conditions the bacillus coli communis is a saprophyte, but it is frequently found in pus suppurations of the intestines in appendicitis, and sometimes in more remote suppurations. In intestinal diseases such as cholera, typhoid, and dysentery, the bacillus seems to acquire extreme virulence, and because of the denudation of the mucous surfaces, finds an easy entrance into the entire system, causing the formation of remote secondary suppurative lesions in which it is a prime factor.

It is also not infrequently the cause of cholera infantum, and when it enters the bile ducts, may result in inflammation, obstruction, suppuration, and calculous formation. This bacillus has also been found in puerperal fever, meningitis, endocarditis, broncho-pneumonia, liver abscess, chronic tonsillitis, pleuritis, and urethritis.

It is an open question among bacteriologists as to whether the colon bacillus is always virulent, or whether pathologic conditions must exist to render it so. Klenki found that the virulence was greatly increased in any strangulated portion of the intestines, and upon its passage through animals.

We have now seen the far reaching, death dealing possibilities in water or food contaminated with typhoid or colon bacilli, and the almost endless chain of human suffering they can bring to pass. Yet in city after city, town after town, and village after village, people are pouring into their water supply every imaginable kind of filth, and then drinking it in a more or less diluted condition, or else passing it on to some other community, and in their turn consuming the same thing floated down to them from somewhere else. To read of such habits existing among a savage and unenlightened people would be productive of disgust, more than surprise, but we have only to look around us to-day to find in countless localities examples of this disgusting practice.

A very eminent physician once said, "For every death by typhoid some one is guilty of murder and should hang for it." It is a disease contracted from filth alone, and when humanity discontinues the consumption of its own sewage, then will typhoid fever cease to be.

Section III

PUBLIC LIGHTING PLANTS

THERE is an unnecessary tendency to complicate this subject, and public lighting devices have not developed sufficiently along the lines of public safety. There is great need to curb the tendency of lighting companies to install what costs the least rather than to erect what is safe.

One of the crudest modern means of public illumination was the great flaring torch consisting of an upright pipe burning natural gas. These torches

were common in the Pittsburgh district not so many years ago, and are still to be seen occasionally where natural gas is cheap and abundant. There is a certain charm to these great flaring torches, and yet the method is too crude for to-day, and not without its elements of danger. High wind resulted in whipping the flame back and forth, and, when the pressure was great, I have noted unconsumed gas vitiated the atmosphere more or less. The air was also charged with fine soot when the gas was rich. Teams were apt to collide with the slight pipes conducting the gas, and start an immense flame dangerous to property if the piping broke. Boys cannot resist the temptation to play with fire, and these big flames attract them unduly. The flickering light is hard upon the eyes, there is too great heat generated in summer time, and these lights were a danger from lightning because they generated a column of heated air that attracts the flash. When struck they were ripped loose, and large volumes of gas ignited. Natural gas makes good street illumination when burned in proper fixtures, but it has the great disadvantage of liquifying or condensing in the pipes when the weather is very cold, and that reduces the pressure to a degree yielding a poor light.

The greatest danger from natural gas is poor piping. Tight pipe lines are hard to procure under the best of construction. The leading of small joints with a screw thread, and the calking and leading of large pipes, as well as split seams and blowholes or faults from sand in cast pipes,—all these tend to produce leaks. Also the pipes will shift in the trench, sag, be contracted by cold and expanded by heat, and the settling of earth and excavations tend to put stress upon them, and the leaks already there become large. Manufactured gas costs so much to produce that the gas companies do everything possible to prevent leakage. Natural gas is cheap, and the tendency is to be less careful in construction. When the lines ran through the ordinary dirt road, no great damage resulted, but I saw a whole city block shaken by a natural gas explosion and great damage to property resulted. The gas accumulated in some kind of a manhole, and a bad joint in an electric wire in a conduit supplied the flame. I have seen whole avenues of beautiful trees killed by natural gas. Especially was this the case when street paving was laid over a defective line of piping. Then, too, the gas is apt to work its way into cellars or the partitions of houses, and being mixed with air, makes a very explosive mixture. Some years ago the writer saw several wrecks of buildings from this cause. Needless to say, the gas produces most deleterious results when breathed by a human being. Do what we will, cellar air gets into the house, and it takes a very small amount of gas to so poison the air that the health of the inmates suffers.

Park lighting.—The old brazier of camp meeting days, in which pitch pine was burned, was the first park lighting in this country. It used to make me think, when a child, of Nero burning the Christians, and it certainly was weird and picturesque. Then came the ordinary gas light, but it cost too much to lay the pipes through large parks. Arc lights are readily erected, but cast too many shadows when trees are plentiful. The high towers with several arc lights at the top suit some parks admirably, but are very apt to blow down and destroy life or property. This form of park

lighting is quite expensive. The city of Baltimore has made large use of the incandescent gas mantle in lighting residence districts, and the general results are so good that many visitors to that city have taken the idea home with them, and one now finds this form of light common in city suburbs and in city parks. The advantage is that gasoline and other light oils can be vaporized to supply the gas and no piping be required. This form of lighting is to be commended where piping is too expensive, or is apt to be defective or be neglected. It is comparatively cheap and offers no especial dangers. Fancy fixtures may be had that accommodate several mantles upon one stand.

Gas plants.—There is some detailed consideration of gas installations within doors, in Chapter XX. Much that is said there applies here, and an extended discussion is unnecessary. Acetylene gas is not adapted to large public plants. Formerly, gas was made from coal almost exclusively, and much of it is thus made to-day. But the so-called “carburetted water gas,” as made from crude oils and steam, is displacing it. There is an exaggerated idea of the danger of gas works, and many persons will not live near to them. There is some odor, but careful management of the plant largely reduces it, and the modern construction provides for the combustion, under the apparatus, of most of the disagreeable vapors. The by-products are better utilized than was formerly the case, and the methods of gas purification has been so improved as to eliminate many objections. The gas plant should not be allowed to discharge its waste into a stream or sewer. Even the “drips” that the gas company pumps out of its mains at the drip traps should not be discharged into sewers, as it has a most persistent and permeating odor far from pleasant. There is a constant danger from fire at a gas plant, and most of them take every precaution. The writer saw a gas plant burn. Every one was terrorized because they expected to see a great explosion when the immense tank “let loose.” What actually happened was that the heat expanded the gas inside the already nearly filled tank and, as it were, lifted the lid off. This liberated an immense volume of gas, and it promptly rose into the air and burned around the edges of the tank. The gas was not mixed with air and did not explode, and the great volume of it escaped without even taking fire. Had it been an oil tank there would have been a great blaze. Municipalities need have no great fear of gas plants. The principal thing is to exact proper inspection of their boilers and machinery, adequate fire protection and precaution, and the keeping of waste products out of streams and sewers.

What was said about the piping of natural gas applies equally here. The big city gas plants have trunk line pipes, several feet in diameter sometimes, or they may have several of them two or three feet in diameter. If they contained an admixture of gas and air, and a spark reached the contained mixture, there would be a frightful explosion. But the public can rest easy. The gas companies have trained men constantly “on the job” and all kinds of recording apparatus to show the real condition of things. Such accidents are not liable to happen in these days of well-trained gas engineers. Whenever one detects the odor of gas from a manhole connecting with a conduit line or public steam-heating plant he should notify the gas office, as an ex-

plosion is a possibility. Gas pipe lines should be regularly inspected by driving a steel rod down through the earth and having a trained man smell for leaks. These men become very expert in locating leaks, and any well-managed gas company has a chart of every rod of line they lay and where all joints are to be found. Leaks under street paving are dangerous, because the gas may work its way into cellars, sewers, or subways.

Electric light.— Aside from spoiling the natural beauty of water falls, the electric light and power companies present no more danger to the public (so far as the plant is concerned) than do the run of factories. It is true there is a danger to be avoided in the plants of these companies, but the public have no especial business there, and the matter is negligible. Very large plants developing high voltage current for long distance transmission are especially dangerous. The writer has noted conditions at Niagara Falls and at York Haven, two of the largest plants, and sees no public peril in such installations. It is the same question the rigger has to face. He will as soon climb up five hundred feet as one hundred. As one said to me, "If I fall five hundred feet I am no deader than if I fall one hundred." The immense voltages carried from these plants will not kill one any more surely than will a fraction of the same. As a matter of fact, the line construction is better with high voltages than with low ones.

It is line construction that more vitally interests the public. The immensely high voltage is usually carried only to the suburbs of the city, and either run through a rotary transformer and distributed at a reduced voltage, or it is carried in underground conduits to a transformer station more centrally located. The line between the large generator and the transformer station is very dangerous, but because of the high voltage is usually so well constructed that the danger is reduced.

Two kinds of current are distributed by the electric light companies, for arc lights and for incandescent. Arc circuits carry a voltage dependent upon the number and resistance of the lamps in the series. Such currents are always dangerous, and especially so in case of fire. City construction of this character is nearly always poor, and live wires may drop to the street from an ordinary storm.

From considerable observation of underground conduit construction, the writer feels justified in saying that any large municipality is entirely justified in ordering all wires in the central business districts underground except those necessary for distribution from the conduits, and possibly long trunk line telephone wires. These conduit systems are entirely practical, the main trouble being to find place for them. There is a narrow alley in my own city carrying a sewer, water, and gas pipes, steam heating pipes, underground conduits for two telephone companies, and an electric light company could not find a place to bury their wires. This is overdoing the proposition, and is an illustration of the wisdom of either municipal conduits with space to rent, or of a conduit company offering such service. We so frequently read of firemen being killed or retarded in their work by overhead wires that it is becoming daily more necessary to remove them, so far as is at all possible. Until induction is overcome in long distance telephone service it is not fair

to ask the telephone companies to bury these wires unless place is found where they can erect their own system and be guaranteed against invasion by alternating currents. In the long run, in territory subject to sleet or ice storms and to high winds, it will pay a well-patronized company to bury their wires. Certainly it tends to public safety. Municipal legislation should require the removal of all dead and unnecessary wires, and arc circuits should be much better constructed than they commonly are at present.

Incandescent wiring *may* be very dangerous. On account of less copper being required, it is common to use alternating currents and pole converters, or stepdown transformers, in incandescent service, especially at a distance from the plant or in the suburbs. I care not what the companies say, this is dangerous practice and should be regulated. A short circuit in the converter often runs a dangerous current into a building, and may fire the building or take life. Beside that, alternating currents are always more dangerous from every point of view than are direct currents. Rotary transformers are so reliable that it is no hardship at all to require all light companies to erect distributing stations so equipped. I do not like to criticize corporations, but I have never personally known of an instance where cheap waterpower generation of electricity resulted in any permanent reduction of the rates to the small consumer. I *have* known instances where the rates were raised. Therefore, it is no hardship to the companies to require of them that they convert their current before distributing it.

The ordinary direct 110 volt three-wire system is the safest thus far devised. It leaves much to be desired, but modern construction is fast eliminating the dangers. Trolley wires are a source of some danger, but their firm construction render accidental contact with the line or trolley wires infrequent. Underground construction, such as is used in Washington city, is too expensive for most lines.

Minor dangers need not be discussed. In Chapter XX there is some discussion of indoor electric installations.

Section IV

OIL — PIPE LINES AND OIL WORKS — OIL REGULATIONS*

Preliminary note.—The Standard Oil Company practically controls the oil industries in this country, and what they do in the way of sanitation is of great public interest. In order to form some accurate estimate of their practice in this connection, I wrote to them for data. Eliminating some general information, the data supplied by them consists of the subjoined paper by Mr. H. C. Folger, Jr., an official of the Company at their New York city offices.

Several of the state boards of health are charged with the testing of oil before it may be sold within the state. After an examination of the laws and regulations of the several states, I have selected those of Iowa as being understandable by a physician,

*By H. C. Folger, Jr.

and, as well, covering the ground. These regulations, as taken from the "Supplement to the Iowa Health Bulletin," follow Mr. Folger's interesting paper.—T. S. B.

Nothing is of more vital interest, or gives those in charge of the Standard Oil Co. greater concern than the safety and health of its workmen and the security and protection of its own property and that of its neighbors, and no practicable suggestion for the betterment of either is neglected. Every appliance or process which promises improvement of conditions is carefully considered with regard to its adaptability and efficiency as a safeguard against accidents.

At all the works the best possible sanitary conditions are provided, such as cleanliness of conditions under which the men work, sanitary buildings, with ample window space for light and air, shower baths or bath tubs, sanitary lockers for men's clothes, sanitary toilet facilities, pure drinking water, etc.

At all the works provision is made "for first aid to the injured" in minor injuries; ambulances are provided to take more serious cases to hospitals; proper medical or surgical aid is furnished, and the pay of injured parties continued during their disability.

At all points the highest prevailing rate of wages is paid for each class of labor employed. Individual ability is recognized by increased pay and promotion, positions as they arise being filled with men from the ranks; finally, a liberal pension system has been established for the protection of old employees.

In the way of protection against accidents, every safety device known as applicable to the business is provided; guards around belts and moving machinery, hand-rails to protect employees from falls, non-slippable steel or iron stairways, etc.; also careful housing of stills and boilers to protect firemen and stillmen from exposure to the weather. An honest effort is made to observe both the letter and spirit of state laws relating to factories and workshops for the safety and health of the men, as well as the installation of such devices as experience suggests. Employees are educated as to the properties of petroleum and its products and the danger incident to the handling of same, and a rigid system of instruction to prevent undue personal risks on the part of employees is enforced.

In regard to the safety of property, the Standard Oil Co. has in all recent construction discontinued the old plan of building refineries with a view to the use of gravitation for delivery of oil, thus avoiding a great danger in the event of fire.

No expense has been spared to provide the most efficient fire protection; all wood construction has been rapidly replaced with steel, concrete, or brick; adequate fire banks and walls around yards and tanks have been built to catch spills of oil and prevent the spread of fire, with complete sewer and separator system to care for oil that might in some emergency get outside of the fire banks. At each works an elaborate fire alarm system, with high pressure lines and pumps under pressure at all times, and an abundance of hydrants and hose, has been provided, as well as a complete system of lines to provide live steam to smother fires in tanks or buildings.

The most approved style of electric wiring, and a daily inspection of fire and electrical apparatus is provided. Inspectors are constantly employed whose sole duty is to watch for the presence of oil which might indicate leaks, especially where such leaks could lead to neighboring property or streams of water, navigable or otherwise.

Everything possible is done to insure the safety of employees and the works, to safeguard surrounding property, and to make the Standard Oil Co.'s plants minimum fire and accident risks.

At nearly all plants, automatic stokers and smoke-consuming devices have been

installed, and everywhere apparatus provided to catch and consume any free gases resulting from the various processes.

In the transportation of petroleum products the wood barrel has to a great extent been eliminated. Tank cars with wood bodies and trucks have been replaced with all steel tank cars, equipped with relief valves and every safety device that experience has suggested or railway regulations prescribed.

In the bulk boat transportation of products the most modern construction is employed, and every known safety device used, such as wireless telegraphy, submarine signals, telegraph system between pilot house and engine room of steamers, modern sounding machines, etc. In case steamers carrying on return voyages general cargo, the "Rich" Fire Indicating System, same as fitted on the passenger steamers "Lusitania" and "Mauretania" is installed.

Experience has shown the tank wagon system employed by the Standard Oil Co. for the handling of bulk products to the trade to be absolutely safe.

The unusually long and continuous service of a large number of the men in the employ of the Standard Oil Co., and the absence of labor troubles in the plants of the Company, is convincing evidence that the working conditions are of the best and that the employer has a real interest in the welfare of the men.

Yours very truly,

H. C. FOLGER, JR.

McK.

IOWA STATE BOARD OF HEALTH

RULES AND REGULATIONS FOR THE INSPECTION OF ILLUMINATING OILS

Kerosene Oil

RULE 1. *The instruments.*—The instrument to be used in testing oil under the provisions of Chapter 87, Section 2, Laws Thirtieth General Assembly, shall be that made by Eimer & Amend, New York, and shall have inscribed thereon the words: "Oil Tester, Iowa State Board of Health," and shall be constructed as follows:

It consists of a sheet copper stand, eight and a half inches high exclusive of the base, and four and a half inches in diameter. On one side is an aperture three and a half inches high for introducing a small spirit lamp, or better, a small gas burner, instead of a lamp, when gas is available.

The water bath is also of copper, four and a half inches in height and four inches in diameter inside, provided with a flanged cover; the opening in the cover two and seven eighths inches in diameter. The flange which supports the bath in the cylindrical stand is one fourth inch projection. The capacity of the bath is about twenty fluid ounces, which is indicated by a mark on the inside.

The oil cup is also of copper. The section below the flange is three and three eighths inches high and two and three quarters inches in diameter. The section above the flange is one inch high and three and three eighths inches in diameter, and serves as the vapor chamber. A small flange at the upper rim serves to hold the cover, which is of glass, in place.

To prevent reflection from the otherwise bright surface of the metal, the inside is blackened by forming a sulphide of ammonia. The capacity of the oil cup is about ten fluid ounces, when filled to within one eighth of an inch of the flange which joins the oil cup and the vapor chamber.

The cover of the oil cup is of glass, three and five eighths inches in diameter; is perforated on one side with a circular opening, which is filled with a cork, through

which passes the thermometer. On the rim is another oval opening three fourths of an inch deep, and the same in width, through which is to be passed the flashing jet in testing. The glass cover is used instead of metal that the operator may more readily note the exact point at which the flash occurs. A small gas jet one fourth of an inch in length is best for igniting the vapor. Where gas cannot be had, and to prevent the frequent discrepancy in tests made by different inspectors of the same oil at different places, owing largely, if not entirely, to the difference in their torches, and to obviate the frequent annoyance from that fact, and from smoke from waxed threads filling the vapor chamber of the cup, thereby preventing an accurate and reliable test, a portable gas torch has been devised, which inspectors in this state are required to procure and use for testing products of petroleum.

The Flash Test

RULE 2. The test shall be made as follows:

Remove the oil cup and fill the water bath with cold water to the mark on the inside. Place the oil cup in the water bath, and fill it with oil to within one eighth of an inch of the flange. Care must be taken that oil does not flow over the flange. Remove all air bubbles with a piece of blotting paper. Place the glass cover on the oil cup and adjust the thermometer so that its bulb shall be entirely covered by the oil.

Apply the apparatus for heating the water bath, and so adjust the flame that the degree of heating will *not exceed* two degrees per minute.

When the temperature of the oil has reached ninety degrees Fahrenheit, the test should commence by inserting the torch, which should have a very small flame, into the oval opening in the glass cover, passing it in at such an angle as to have the flame about three eighths of an inch above the oil, and reaching near the center of the vapor chamber.

The motion must be steady and uniform, rapid, and without any pause. This must be repeated at every two degrees' rise in the thermometer until one hundred degrees is reached, when the torch must be applied at each degree of temperature until one hundred and five degrees is reached. Great care must be exercised to secure accuracy at this point, and to this end the torch must be applied just before the temperature reaches the one hundred and five degree point. If no flash is shown at this point continue the test at each two degrees' rise until the flashing point is reached, which is indicated by the appearance of a slight bluish flame *ON THE SURFACE OF THE OIL*. The *lowest point at which this vapor flame appears on the surface of the oil*, and a perceptible flash is produced, is to be designated as the flashing point. The temperature of the oil must be noted before the torch is applied. The flame of the torch must not touch the oil or come within three eighths of an inch of its surface. Oil that flashes at one hundred and five degrees, or below that, must be rejected. (Section 3, Chapter 87, 30th G. A.)

As cold oil will expand by heating, care must be taken that it does not rise so as to flow over or on the flange or shoulder of the oil cup. That part of the oil cup comprising the vapor chamber and the flange must be dry and entirely free from oil. All air bubbles must be removed from the surface of the oil; this can be done with ordinary blotting paper. The water bath cup must be filled with cold water for each separate test, and the oil in the cup brought to a temperature of sixty to sixty-five degrees before the lamp is placed under the water bath. The oil cup must be carefully and thoroughly wiped dry of oil from the previous test. The flame of the torch must not exceed one eighth of an inch in length or size.

For Testing Three Hundred Degrees

RULE 3. The instrument to be used for testing oils which come under the provisions of Section 6, Chapter 87, Laws thirtieth General Assembly shall consist of the cylinder, the copper oil cup, the copper collar, for suspending the oil cup in the cylinder, and an adjustable wire support for suspending the thermometer in the oil.

Igniting and Burning Test

RULE 4. To ascertain the igniting and burning point the test should be made as follows:

Fill the cup with the oil to be tested to within three eighths of an inch of the flange joining the cup and the vapor chamber above. Care must be taken that oil does not flow over the flange, by expansion from heating. Place the cup in the cylinder, covered with the collar. Adjust the wire support so that the thermometer bulb, when supported thereon, will be just covered by the oil, the bulb also being near the center of the cup. Place the lamp or gas jet under the cup. Adjust the flame so that the degree of heating will not exceed ten degrees each minute until two hundred and fifty degrees Fahrenheit is reached, when the rate must not exceed five degrees a minute above that point. The torch to be used must be the same as described in Rule 1, for obtaining the flash point. Apply the torch lightly across and not less than three eighths of an inch above the surface of the oil at each five degrees rise in the temperature, until the oil ignites and burns. The lowest point at which the oil will ignite and burn is to be taken as the burning point, and no oil which burns at a temperature below three hundred and one degrees Fahrenheit must be approved for the purposes set forth in Section 6, Chapter 87, Laws Thirtieth General Assembly. When approved, the package, cask, barrel, or vessel containing the oil from which the oil tested was taken, must be branded with stencil No. 3, as provided in said section and Rule 8. The actual point at which the oil burns must be branded on the barrel. If it burns at three hundred and one degrees, or below that, it must be rejected. In this test the water bath cup and the glass cover are not used, the flame of the lamp being applied directly to the bottom of the oil cup.

General Rules

RULE 5. All instruments, testers, and thermometers to be used by inspectors must be approved by and registered in the office of the state board of health.

RULE 6. Inspectors must have all previous brands of tests removed from packages, casks, or barrels before affixing their brand thereon.

RULE 7. Brand Number 1 must be circular in form, not less than eight inches in diameter, outside measurement, with ample margin to protect the vessel or barrel from the stencil brush, and must contain the following words: "Approved, flash test. degrees, Iowa." And also the name of the inspector, date of inspection, and degree of test. It must be arranged also for adjustable dates and the degrees of test.

RULE 8. Brand Number 2 shall be square in form, not less than seven inches, outside measurement, without date, and must contain the following words: "Rejected for illuminating purposes., Inspector, Iowa." It must contain the name of the inspector; it must be affixed to all packages, casks, cans, barrels, or vessels containing kerosene which does not flash at a point above one hundred and five degrees Fahrenheit. It must also be affixed to all packages, casks, barrels, or vessels containing gasoline, naphtha, or benzene.

Brand Number 3 shall be of like form and dimensions as brand Number I, and shall contain the words: "For illuminating cars, approved (or rejected as the case may be) degrees, Iowa,.....190.....Inspector." It shall have adjustable spaces for dates, degrees, and the words "approved" and "rejected." It must also contain the name of the inspector. No oil must be approved for illuminating cars that burns at a temperature below three hundred and one degrees Fahrenheit.

Stencil brands must conform to patterns on file in the office of the secretary of the state board of health.

Inspector's Brand

RULE 9. The inspector's brand must be placed on the package, cask, or barrel, in clear, distinct letters, and must be affixed by the inspector in person, or by some person under his personal supervision and control, who is not directly, nor indirectly, interested in the manufacture nor sale of any product of petroleum. The brand of an inspector is deemed to be his official signature, and must not be permitted to pass out of his custody or control except when otherwise ordered by the chief inspector.

Certificate of Inspection

RULE 10. Upon the inspection of oil by an inspector, the inspector shall deliver to the owner of the oil, or the person for whom the inspection was made, a certificate of inspection, which shall be in the following form:

(Copies of the labels and blanks are omitted.—T. S. B.)

Mixed Grades — Average Test not Permitted

RULE 11. Where oil of different grades, or standards, is placed in receiving or storage tanks, an inspection must be made, and the actual standard of oil from such tanks obtained at all times before it is put into barrels for sale and use. There must be no averagetest, by taking an average of the different qualities or standards of oil before it is placed in such tanks. The inspector must know the quality and standard of the oil before he affixes his brand thereon. Where a number of barrels are filled consecutively from a tank, previously inspected, an inspection of one barrel would suffice for that particular lot of barrels, *provided*, no oil has been added to the tank during the process of filling the barrels. The barreling, testing, and branding must constitute one transaction. There must be no lapse of time therein. The statute requires all products of petroleum, kerosene as well as gasoline, to be inspected and branded. The branding is notice to the public of the inspection. The statute makes no distinction in the form or size of the vessel in which such product is placed. It is no less imperative that when fifty gallons of kerosene are drawn from a tank into five ten-gallon cans that the cans should be branded than that fifty gallons of kerosene taken from the same tank and put into a barrel be branded. When a product of petroleum to be used for illuminating purposes has been inspected, the fact of such inspection must be shown upon the vessel from which it is to be sold again or used. When inspected in a storage tank or tank car, it need not be reinspected when barreled or canned, but the barrel, can, or package must be branded according to the actual standard of the article contained therein. The barrel or vessel must not be branded before filling.

Empty barrels to be subsequently filled with gasoline may be branded with stencil Number 3 as "rejected for illuminating purposes."

Every Barrel Must be Inspected

RULE 12. Oil received from jobbers in barrels is frequently of various standards, and the actual standard cannot be ascertained except by a separate test of each barrel. There must be no average or cumulative tests. For instance, a sample of oil taken from five barrels of one hundred and two degree oil and five barrels of one hundred and eight degree oil would give a mixture that would, when tested, cause the whole ten barrels to be rejected, whereas five barrels, separately tested, would have to be approved. Averages are not permissible in the inspection service. Every barrel must be tested.

RULE 13. Where oil is shipped into this state in barrels, or from one point in this state to another point in this state, that has not been lawfully inspected within this state, each and every barrel must be inspected and the oil therein tested. The testing of one barrel will not authorize an inspector to brand the entire number as of the standard of the barrel tested.

The practice of jobbers in delivering oil to retail dealers without inspection is a direct violation of law. The delivery constitutes prima facie evidence of sale. A retail dealer receiving a lot of uninspected oil cannot justify himself for selling such oil on the ground that the jobber is responsible to the state for the violation of law. He must immediately notify the inspector that the oil is in his possession. Inspectors must exercise diligence to arraign offenders and stop the practice. They must, with strict impartiality, insist upon obedience to law in their respective districts.

Oil in Transit

RULE 14. Oil in transit must not be inspected outside of the district to which it is sent.

Inspector to Report Explosions to State Board of Health

RULE 15. In case of a lamp explosion the inspector in whose district the accident occurred shall immediately investigate all the facts in connection therewith and report the same to the state board of health.

Inspections to be Made Without Delay

RULE 16. Inspectors must regard their duties as inspectors paramount to all other duties, and upon notification must perform them without delay.

Only Tested Thermometers to be Used

RULE 17. No thermometer shall be used by inspectors for testing oil unless the same has been calibrated and tested for errors at the observatory at Yale College, and a certificate secured showing the result of the calibration. A copy of all such certificates shall be sent to the secretary of the state board of health, and recorded in his office.

Inspection of Miner's Oil

In pursuance with the provisions of section 2495-a-Code Supplement, the state board of health adopted the following rules:

RULE 1. The specific gravity of oil used for illuminating purposes in coal mines must not exceed twenty-two degrees, Tagliabue hydrometer, at sixty degrees temperature Fahrenheit.

RULE 2. All oil must be tested in a glass-footed cylinder, one and one half inches in diameter and eight inches deep.

RULE 3. Fill the hydrometer jar to within three fourths inch of the top, introduce the hydrometer, cool or heat as the case may be to sixty degrees, Fahrenheit. Allow the hydrometer to come to rest, read from below, and the last line which appears under the surface of the oil should be regarded as the true reading, care being taken that the hydrometer does not touch the sides of the jar when reading.

RULE 4. Fill a round, clear glass bottle two thirds full with the oil and shake well; the bead should not show fluorescence similar to that of petroleum products.

RULE 5. Fill an ordinary miner's lamp with the oil, light, and note character and quantity of smoke.

RULE 6. All material used for illuminating purposes in coal mines shall be free from smoke, bad odor, and by-products of resin, known as mystic oil.

RULE 7. Paraffine wax should not contain more than three per cent of oil, and the maximum melting point shall be one hundred and ten degrees Fahrenheit. To test the melting point of paraffine wax, place a chip of it on hot water, then allow the water to cool slowly, and note the temperature of the water when the wax globule loses its transparency.

RULE 8. In all cases of doubt, or question as to inspection, or as to the purity of the oil or paraffine to be used in mines, a sample of the same shall be furnished the state board of health for chemical analysis.

All oils, therefore, sold by dealers or their agents, or furnished by mine owners or operators, or used by miners in any of the coal mines of Iowa, for illuminating purposes, shall, previous to such use, have been duly inspected and branded by some district oil inspector, legally qualified by the state.

Only the regulations are here presented. The laws are quite lengthy, and are so well indicated that what is given in the regulations conveys an adequate idea of their requirements.

SEWAGE DISPOSAL PLANTS

No separate chapter is given to the exclusive consideration of sewers, but Chapter II discusses them as they relate to public buildings, Chapter VII considers some bad features of drainage, Chapter VIII touches upon the rural problem and small sewage disposal plants, and Chapter XX tells what inside connections to sewers are correct in principle. This present chapter tells somewhat of the Chicago drainage canal in the last section of the chapter.

Before considering sewage disposal plants, it is necessary to discuss outside sewer connections. Most cities have specific ordinances regulating the installation and any later repairs upon such sewers. I have examined several such ordinances, and believe that the best one I have seen is "Ordinance No. 86," passed by the Municipal Board of the City of Manila, P. I., but which is too lengthy for reproduction here. The District of Columbia has an excellent ordinance suitable for most any American city.

Permit me to call attention to several points of sanitary importance with reference to sewers upon premises and communicating with a municipal system. Boards of health should have the right to enter upon private premises to inspect sewers; there should be mechanical and sanitary standards

exacted by every city; water and sewer pipes should not be laid in the same trench unless separated by concrete or a space, depending upon the nature of the soil; sewer and house drain pipes should be well bedded; grades should not be less than one in fifty; every dwelling should have a separate sewer, and no sewer should be placed under buildings to a greater extent than is necessary, and when necessary the pipes should be of iron.

Details are discussed in Chapter XX to as great an extent as will be apt to interest the general practitioner. Municipal or street sewers involve many engineering problems we need not discuss. However, there is no one department of municipal contracting offering greater opportunity for "graft." It is not a very agreeable task to wade through mud and slush and inspect sewer construction. However, I have done so and also gone underground into sewers while in action to see what I could see. Probably the greatest post mortem examination ever undertaken was the survey of San Francisco sewers after the earthquake and the invasion of bubonic plague. Conditions for which the earthquake was not responsible amazed the investigators. And I verily believe that just about the same conditions would be found in other cities were a similar survey undertaken. I do know that the inside of an active sewer is not inviting, and one who never waded through one can have little idea of the miscellaneous assortment of objects found therein, and the large numbers of rats infesting them. With all deference to my engineering friends, I fear that they have tried to devise too cheap sewer construction in America. The continental cities do the thing better. I have been in the French *type* of sewer. The one I saw had a covered sewer in the base of a tunnel in which one could walk upright and the tunnel contained water and gas pipes and some steam-heating pipes, wires for every kind of service, and had incandescent lights inside with the switches so arranged as to turn out the lights behind and turn on those ahead of the person going through. It would impress me that a city could afford to construct such subways or tunnels, and rent out service therein. The base could carry regular sewers and storm water sewers, tracks could be laid for underground freight like is seen in Chicago, water and high pressure fire mains could be beside the tracks, public steam-heating pipes could be cleated to the side walls as well as trolley feed wires and those for electric traction service such as is found in Washington, the light and power companies, telephone, telegraph, district messenger service, fire and police service wires, and every other sort of wiring except distributing wires and possibly trunk lines for long distance telephone service could go into the tunnels. The rentals would gradually retire the bonds issued to cover cost of construction and the benefits would be most too manifold to detail here. However, it must be said that these sewers aggravated the flood troubles of Paris in February, 1910.

There is often a tendency to oppose long sewers. From what I can learn, a long sewer tends to convert much of the sewage and impresses me as good practice. Long intercepting sewers act somewhat like the septic tank.

Existing sewer systems can often be improved. I saw a sewer torn out because it was regarded as inadequate, and it was found that the original political contractor left large rocks standing, and built the brick arch sewer

right over the rocks, leaving them as a permanent obstruction inside the sewer. Plenty of people must have known of it, but nothing was done. I was inspecting an unfinished sewer during a rain storm of light degree. The floor of the sewer was finished, and I noted that the storm water was actually flowing in a direction opposite to the supposed grade of the sewer. Calling the attention of an engineer to it, I was told to go where rainstorms never come. These things *do* happen, and it is time we gave more heed to the proper construction of our sewers.

Sewers emptying into streams should not be so placed that low water allows the sewer outlets to be exposed. That is an important matter I will discuss later, and do not want to be construed as favoring the practice of contaminating streams with sewage except in exceptional instances, such as the Chicago drainage canal.

There are too many carelessly constructed sewer inlets and they are apt to become offensive in dry or hot weather. In dry weather they should be flushed out from the fire plugs. Much of the offensive odor in hot weather is due to street sweepers dropping matter into the inlets. Both these inlets and the grates draining trolley tracks emit a foul odor in summer. I may be more or less in error, but believe the sewers are not properly ventilated. It impresses me that if it is necessary to extend soil pipes above the roof, it is equally a good thing to ventilate the main sewers from stacks discharging the gases high into the air. They could be readily erected along the sides of buildings. That great quantities of gases may remain stagnant in a sewer was forcibly demonstrated to me several years ago in Pittsburg. There was an explosion in a sewer that tore great holes in the street and broke the plate glass windows in several stores. Inquiry developed the fact that there was a small illuminating gas leak discharging into a sewer and a spark set it off. Last October a square mile of New York city was shaken by a sewer explosion. Proper ventilation should have carried the gas away. There is a general tendency upon the part of plumbers to assume that properly trapped work is impervious to sewer gas. All one needs to do to become skeptical upon that score is to pour a pint of gas "drips" into a sewer and await the complaints of the neighborhood. In most sewers the penetrating odor of the gas "drips" will work into half of the buildings in the block. It is surprising what a degree of pressure will result from accumulated sewer gas. I believe that all sewers should be ventilated. A stack every three or four blocks with an electrically operated fan in the same to create a current of ascending air would suck out of the sewer the offensive gases and render back pressure of sewer gases all but impossible. It is all very well for municipalities to insist upon good plumbing inside of buildings, but they should also see to it that the street work is equally good.

There are unsolved problems about sewage itself. In the United States we are very free in the use of water, and most city sewage is more dilute than is the case in Europe. For this reason, much of the European data as to sewage disposal does not apply here with equal force. American sewage is said to contain but one part each of urine and of other organic matters to one thousand parts. Consequently all is water except one fifth of one per cent.

It would seem from this that sewage could be purified readily by filtration to remove the gross parts and run the fluid into reservoirs to be chemically treated and liberated into a stream. If we did not have to contend with storm water and factory waste this very thing could be readily done. It would also seem that the sewage itself being so dilute, further dilution in a stream of water would remove all danger. Theoretically, it may be done; practically, it does not work so well. Theoretically, Lake Michigan should take care of the sewage of Chicago, but it failed to do so, and Chicago was obliged to undertake a different plan for sewage dilution, as described in the last section of this chapter. As a matter of fact, the Great Lakes do not discharge so much water as people imagine. The United States Hydrographic Reports show, so I am told, that the Susquehanna River at time of flood carries past Harrisburg twice as much water as goes over the Niagara Falls. To look at Niagara and then look at our quiet river here, one would never judge that the facts are as stated. But few cities are so placed as is Chicago, and so cannot avail themselves of the plan of sewage dilution. Sea-side cities have thought that the ocean surely would take care of their sewage. In some places it seems to do so very well, but harbors should not be so contaminated and sewage poisons oysters and the best varieties of fish. Places with bathing beaches object very naturally to sewage contamination, and sea water precipitates matters from sewage and nasty reefs are formed just out from shore.

It is necessary when estimating the amount of alleged "safe" contamination to figure the minimum flow of the stream and the maximum flow of the sewage. In the chapter upon "Rural Hygiene," the contamination of streams by the coal washeries is considered. But there are other mine and factory wastes contaminating streams. It is probably the case that certain streams must be given over to the uses of certain industries and abandoned as a source of water supply, but to allow this as a matter of routine wherever corporations wish to use the streams would leave very few pure water streams in any of the thickly populated states. Probably as fair a presentation of the subject as I have seen is that in the 1908 Annual Report of the New York State Department of Health. From it the following is quoted:

RESEARCH WORK AND POLLUTION OF STREAMS

If our struggle during the past four years against the pollution and defilement of the streams of this state proves anything, it is that we have reached a crisis in our progress for better sanitation that must be faced without fear or hesitation.

Broadly but scientifically speaking, there is a limit to the amount of pollution which any stream of known size and character can with sanitary impunity receive, and the results of investigations made by this department covering a number of years form an impressive if not grave testimonial to the fact that many if not most of our larger streams have reached this limit, and in many cases have even passed it. The serious pollution that occurs at many points along the Hudson, Mohawk, Black, and Susquehanna rivers are flagrant examples of the use and abuse that has been made of our once beautiful streams, as depositories for sewage and industrial wastes.

The vital question arises, then, at once — how are we to dispose of all this sewage

and manufacturing wastes in a practical and economical manner, without causing a pollution of our streams? Furthermore, how are we to enforce the adoption of any means or methods by which this removal can be accomplished in those municipalities that would wantonly continue this pernicious custom?

To the first of these questions we may reply without restriction or reserve that, in so far as the municipal sewage is concerned, or that class of wastes most closely associated with public health, sanitary science has, after many years of research work and experimentation, afforded us a solution; and there is no longer any need, nor excuse, for a municipality to discharge its raw sewage into any stream where a menace to health, or a nuisance, can thus be avoided. Sewage tanks, sand filtration, contact beds, or sprinkling filters can now be readily designed and constructed to meet all the requirements of satisfactory sewage disposal under practically all local conditions that are likely to be met with in practice. Indeed, the question before health authorities in dealing with this class of wastes is no longer *what* should be *done*, but *how* to *enforce* the *doing*.

With that class of wastes arising from manufacturing or industrial occupations, however, the question is quite different, with respect not only to its sanitary significance, but also to its means of satisfactory disposal. We are learning daily on the one hand to differentiate more sharply between the evil effects caused by industrial wastes of non-pathogenic origin and by domestic sewage which may be of pathogenic origin. We are learning, on the other hand, that notwithstanding the comparative harmless pathogenic nature of these industrial wastes, they are in many cases of such offensive character, and are discharged in such large volumes, as to create nuisances vastly more serious than those produced by the lesser but more virulent domestic sewage of human origin.

With many of our streams this pollution by industrial wastes presents a serious problem, complicated not only by engineering but also by sociological difficulties, and the solution of which will have to be worked out with considerable caution. These wastes vary greatly in composition, strength, and volume, and in very many cases no scientific methods of practical and economical purification are known. Again, many of the local nuisances resulting from the industrial operations are in communities which have to depend upon the existence of these mills for livelihood and support, and where the expense of purification or the closing of the mill might on more practical grounds be considered more serious than the existence of the nuisance.

It is evident, then, that if any effective and lasting progress is to be made in the removal of these objectionable mill wastes from our streams, it must be sought along lines that will, first, furnish practical information as to methods of purification and, secondly, establish authority to enforce the adoption of those methods. Research and experimental work only, carried out on a practical scale, under the general guidance or supervision of a central body such as the State Department of Health, can accomplish the first of these prerequisites; whereas suitable laws, such as would empower the state commissioner of health or other executive to require and enforce the installation of practical methods when these have been discovered by such research work, would seem to be the only effective means by which the second prerequisite can be fulfilled.

The *disposal* of sewage is a big problem, but its *purification* is a larger one. We have been discussing the former factor and purpose, taking up the latter. To conclude what is necessary to say concerning the mere disposal of sewage, one is forced to the conclusion that disposing of sewage is merely passing it on to our neighbor.

But the limitations of small communities are so obvious that the difficulties are great, and we cannot expect ideal conditions all at once. The present duty of individuals and municipalities not yet ready to purify their sewage consists, first, in realizing that the old idea of streams purifying themselves has been vastly overworked and overstated; second, that we should investigate and find out the exact present condition of existing sewers and correct errors so far as is possible; third, that the places where sewers empty should be cleared of obstructions, and when discharging into streams, the sewer pipes should not be exposed but should be at all times under water; fourth, an engineer of ability should be employed to plot all existing sewers and formulate definite and consistent plans for possible extension with a view to final purification of the sewage; fifth, remember that the whole tendency of legislation is toward the prohibition of stream pollution, and no city can afford to stand in the way of proper advance along hygienic lines.

On the other hand, I want to commend to sanitarians the sensible attitude of the New York State Department of Health. Admittedly there are many difficulties and they will be met when some problems are settled. All extensive changes in sewage systems cost money, and cities and corporations are much like individuals, they do not always have the money to do as they would wish.

But notwithstanding what the New York Board says, the time is rapidly coming when the factories must cease polluting the streams. Such pollution kills fish by the wholesale. Especially is this true as regards acid wastes. Dr. Harold B. Wood says that wastes from dye works, sulphuretted hydrogen from starch works, lime from bleacheries, waste from glucose works, washings from culm banks, waste from wood pulp mills, pollution from oil wells and gas factories, and countless other industries kill the fish. If the resultant injury to other property could be assessed upon the factories, ways for caring for factory wastes would be devised within six weeks. Before the factories emptied millions of gallons of waste into the Passaic River the land along the river averaged in value about six hundred dollars per acre, and was used for agriculture and grazing. But the factory waste soon made it of no value whatever for these purposes. It does not seem fair for these factory wastes to be emptied into the municipal sewers except in the case of very small places doing a business developing little waste. Each factory should have its own disposal plant operated by filtration, coke purification, aluminum sulphate, ferrous sulphate, lime, or other process. Proper study of the matter will often result in the discovery of means for the separation of valuable by-products from these factory wastes, and that will cover or even more than cover the cost of purification. No factory has any more right to discharge impurities into the streams than has the individual.

And this latter brings up the point about the duty of the physician as to the disposal of the discharges of his patients ill with communicable disease. The chapter upon disinfection discusses the matter, but I wish to quote here from an editorial in the *Journal of the A. M. A.* (October 2, 1909), and that shows the weakness in a mere perfunctory "disinfection." No patient or physician has any legal or moral right to empty dangerous discharges into the sewer.

Contagium must then emanate ordinarily from the patient himself, and from his various secretions or excretions. Which one of these carries the greatest amount of the particular contagium depends on the particular disease. Certain it is that not sufficient hygienic or sanitary care is taken by the physician, nurse, and family of the patient's secretions and excretions. Ordinary disinfection of stools and sputum, with chlorid of lime, carbolic acid, corrosive sublimate, and even formalin solutions, have been proved not to kill specific bacteria in the central parts of the excreted masses. In other words, allowing sputum and feces to stand, even for several hours, in even strong antiseptic solutions, is an ineffectual method of killing the germs of infectious or transmissible diseases. To be effectual, discharges of all kinds must be thoroughly broken up into minute particles before antiseptic solutions can be guaranteed to kill all germs. The disinfection of privy vaults by the usual methods is simply futile, and deep privy vaults in villages and country towns, where there are no sewerage facilities, are dangerous to the community in proportion to the depth of the vault. The nearer to the surface of the ground, and the more the air and sunlight reaches the deposits, the less the likelihood of drinking water contamination and of persistence of life in pathogenic germs.

All discharges from the mouth, throat, and lungs should be received into paper sputum cups. Once or twice a day, oftener if necessary, the cup and the contents should be burned, the container washed in an antiseptic solution, and a new cup given the patient. Discharges from the nostrils should be into gauze napkins, and these should be placed in a paper bag at the head of the bed, and the bag and contents burned. Cleansing pieces of cloth or gauze for the mouth and nose should receive the same treatment, viz., be placed in paper bags and burned.

The urine should be passed into vessels that contain one to five hundred bichloride solution, or other strong antiseptic. The urine should then stand in this vessel, which should be covered for an hour. It is then absolutely disinfected, and may be poured into the closet.

The bowel discharges should be into vessels that contain strong bichloride of mercury solutions, or chloride of lime solutions. The fecal clumps should then be thoroughly broken up with a stick, and boiling water, in large amount, poured into the mixture of feces and antiseptic. Enough of the boiling water should be used to raise the mixture almost to the boiling point. After an hour the contents of the receptacle may be considered aseptic and may be poured into the closet. This treatment of the feces should be followed out in typhoid fever, bowel infection, acute diarrhea, cholera, dysentery, acute tuberculosis, intestinal tuberculosis, and in intestinal cancer.

All cloths used in cleansing the body of the patient should be put into paper bags and burned. The clothing of the patient, the bed clothing, and the clothing of the nurse should be boiled, if clothing is washable, and what is not washable should be baked.

Storm water is the third problem, since it flushes out a septic tank long before the contents are converted, or imposes so great a volume of fluid upon the sewage disposal plant as to swamp it. I know very well that some gentlemen who conduct these plants say they can handle storm water, and yet render the sewage innocuous. Perhaps! Storm water comes from the whole watershed of the stream, or usually does, and that from the city streets is a small portion of the whole. Therefore it would not impose much more danger to allow *all* storm water to run directly into the stream. Special storm water sewers are practical and relieve the disposal plant of a vast deal of fluid. Personally I do not think much of sewer inlets upon the streets. Gutters

carrying nothing but storm water are not so bad. When a street is paved and swept daily, and all factory and house wastes are rigidly kept off the streets and out of the gutters, there is less odor than comes from the sewer inlets. By this plan the storm sewer would not be needed, and the sewage disposal plant would not be drowned out, as in my *practical* ignorance of the matter surely *looks* to me to be the case. And none of the experts have satisfied my skepticism thus far. We are a great people to think we have lost our difficulties if they are only placed under ground and we overdo the idea.

Having discussed the preliminaries, we will now enter directly upon a consideration of the disposal plant. But the writer must be pardoned in the expression of some very positive ideas upon the subject. First of all, these preliminaries are important, and a disposal plant should be regarded as simply *a part of a system* of sewage collection, carriage, purification, and final disposal. While it is true that there are many plants in Europe and several in America that are ideal, it is equally true that there are more plants becoming more and more defective as they wear, clog up, or are overworked. Some of them you can smell from afar. It takes very intelligent care to properly operate a sewage disposal plant. The large municipal septic tank is even more liable to give trouble than is the individual one, unless it receives constant attention. Do not be deceived by young and enthusiastic engineers. What I say here is not merely my own personal views, but also those of some of the engineers and other gentlemen who have had largest experience with these plants and for several years. On the other hand, there is not the slightest doubt that a well-planned, well-built, and well-managed sewage disposal plant is one of the best investments that a city can make, and *such a plant does work*. Permit me, however, to draw attention to the fact that cast iron specifications or uniform plans for such plants covering a whole state simply show that the engineers of the state board either do not know much about sewage disposal, or are overruled by others in the issuance of regulations. In Chapter II the Michigan uniform specifications for public buildings are dwelt upon. They are to be regarded as *minimum* requirements, and as such are of value. Some of the specifications of state boards of health regarding sewage disposal are to be viewed in the same light. But a large plant for a town or city should follow specifications prepared only after expert survey and study of conditions. The excellent division of engineering of the Pennsylvania department of health is endeavoring to pursue this latter course. It must not be forgotten also that some of the methods and devices used in sewage disposal plants are in an experimental stage, and that the subject has not developed to anywhere near perfection either in machinery or method of control and operation.

The Illinois State Board of Health has published an article upon the septic tank that is so clear that I take the liberty of quoting a portion of the article and presenting a modified sketch adapted from one found in the article.

ADVANTAGES OF THE SEPTIC TANK

In all its investigations no plan has proven so satisfactory in actual use as the septic tank, and the conclusions drawn from investigations of such plants now in use

in the state is that *the septic tank properly cared for and properly operated will give the safest and best means of sewage disposal* with the smallest outlay for original construction, and the smallest outlay for subsequent maintenance.

A further advantage of the septic tank is that it requires but a very small piece of ground, and that it may be operated in thickly settled neighborhoods without becoming offensive. As an example of the maintenance of septic tanks in a settled community without causing a nuisance or conditions which might be unsightly, the septic tanks of the village of LaGrange may be cited. These tanks are located entirely under ground, and are covered by broad cement pavements, with occasional manholes to be used in the plant's operation. Undoubtedly hundreds of persons walk along the streets of LaGrange, and over what they take to be a broad concrete promenade, without realizing even if the manholes are open that the sewage of the village is undergoing decomposition and purification immediately beneath their feet.

The septic tank is adapted to the needs of communities of considerable size as well as to those of a single building. The entire sewage of such places as DeKalb, Kewanee, LaGrange, Robinson, and Urbana, of the Allis-Chalmers works near Milwaukee, and of the Soldiers' and Sailors' Home at Quincy is disposed of by means of the septic tank. That at the Allis-Chalmers works is an evidence of the remarkable purity of sewage having undergone this process. It receives the sewage of over two thousand people, and the water coming from the filter beds runs down a brooklet through the park of the National Soldiers' Home, and is utilized as a supply for the ponds and lakes which form an essential feature of the landscape gardening of that place. There has never been a time when there was the slightest odor or the slightest turbidity of the waters of the brook or ponds.

CONSTRUCTION OF THE SEPTIC TANK

The septic tank is a tank varying in size according to the amount of sewage to be handled. It is constructed of brick, stone, or cement, and situated wholly or partially under ground. The top may be flat or arched. There is an inlet for sewage at one end and an outlet at the other. The inlet and outlet are at about the same elevation. Across the tank at frequent intervals are a number of arches, so placed that they extend eight or ten inches below and a few inches above the level of the inlet and outlet. In this tank the solid, organic matter of sewage emptied into it is decomposed by the action of bacteria.

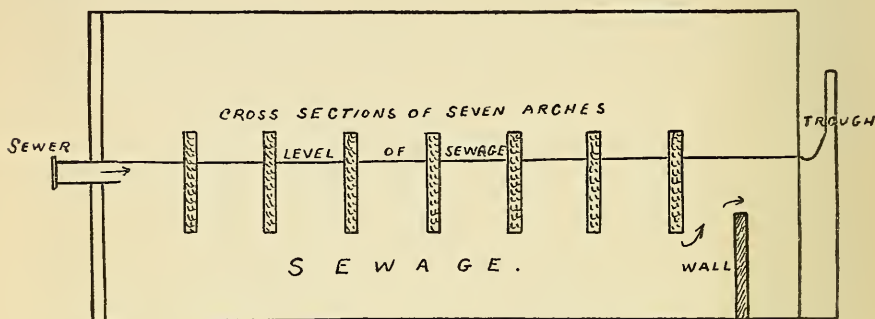
OPERATION OF SEPTIC TANK

When the sewage empties into the tank most of the organic matter rises as a thick scum in front of the first arch. Here decomposition begins, gases are given off, and the solid matter, with gases liberated, falls to the bottom of the tank. Here further decomposition takes place, and again charged with gas it rises to the surface in front of the second arch, there gives off its gas, sinks again, and so continues until it reaches outlet. Here it falls behind the wall that prevents the solid part of the sewage from escaping until completely decomposed. Freed from all solid matter the liquid sewage passes slowly out into the outlet and is carried away.

The effluent is clear, comparatively free from odor, and comparatively harmless. If a filter bed is supplemented to the tank, the effluent is absolutely clear, free from odor, and may be emptied into streams whose water is used for drinking purposes without the slightest danger.

PLAN FOR A MUNICIPAL SEPTIC TANK

The chapter upon "Rural Hygiene" contains plans for a small septic tank. This seven-arch tank is explained in the text. The wall prevents the solid part of the sewage from passing out at the trough until it has undergone complete decomposition. The trough carries the effluent away, preferably to filter beds but sometimes into ditches or streams.



FAULTY OPERATION

In the investigations of septic tanks, conducted by the Illinois State Board of Health, two common factors have been found instrumental in failure of sewage disposal plants. First, many of the septic tanks now in operation are improperly constructed. The essential principles of erection have been ignored. Many tanks have been built by those who have had only the most vague ideas as to what was to be accomplished. Further, many tanks have been found which were totally inadequate in size, receiving sewage far in excess of their capacity, causing the effluent to differ little from the raw sewage pouring into the inlet.

The second cause for failure, however, is the most common and the most important — faulty operation and faulty management of the plant. There is no septic tank, however perfect its construction, which will operate properly unless given some attention, and yet in the case of a number of the municipal tanks in the state, there is either absolute neglect or the persons in charge do not understand their operation.

The septic tank requires very little attention, but that attention must be given it regularly and intelligently. There is a gradual accumulation of sludge in every tank — a quantity which, considering the quantity of solid matter passing into the tank, is astonishingly small — but it nevertheless must be pumped out occasionally. Where several tanks are used there must be some attention given to the quantity of sewage being treated, and there should be enough tanks in operation to accommodate all of the sewage, but not enough to cause too long stagnation of the sewage within the tank. Further, the gates and traps of the tank, while simple in operation and in construction, must be occasionally watched and kept in repair. Trifling as these details of operation seem to be, their neglect will eventually render a well-constructed septic tank useless.

In an investigation of septic tanks, made recently, it was found that in a municipal plant, well located and perfectly constructed, the effluent contained a considerable amount of solid matter (sludge), and was more or less offensive. The tank contained two chambers, the combined capacity of which was ample to meet the necessities of the city for several years.

On investigation it was found that one of the tanks was not in use; that the other tank had been used continuously for over three months and that during that time no sludge had been pumped from it; that a gate at the inlet was broken so that the inflow could not be properly controlled. To have inspected and regulated this plant would have required possibly a half hour a week. To remove the sludge would have taken a few hours every few months. To have repaired the gate would probably have cost a dollar. And yet these trifling neglects caused the entire plant to operate unsatisfactorily.

The failure of a neglected septic tank to do good work cannot be sanely construed to condemn the process.

Municipalities contemplating improvements in sewage disposal should investigate septic tanks; those that contemplate the installation of septic tanks should take pains to secure good designs and construction, and after construction the details of operation should be given intelligent attention.

By arrangement with the city of Urbana the municipal septic tank at that place is being operated under the joint direction of the state water survey and the state board of health, as a model to individuals and municipalities contemplating the installation of sewage disposal systems. An inspection of this plant cannot fail to be profitable.

Some of the authorities are not so enthusiastic about the septic tank, but whatever they may say, it remains a practical method for the treatment of sewage and can be a *portion* of any plant to advantage. There are doubtless conditions in which the septic tank alone will adequately handle the sewage, but in others the effluent should be filtered or treated with ozone before being discharged into streams. A few years ago, the septic tank was considered more effective in the removal of bacteria than the later laboratory tests proved to be the real state of the case. But it is safe to assume that a good septic tank will remove one half of the total bacterial content from raw sewage.

There has been such an immense amount of matter published bearing upon sewage disposal that the present writer realizes the complexity of the matter from many points of view, and is merely touching upon the salient features of the work. Probably as good a book as the physician interested in sewage disposal could procure, is that by Dunbar on "Sewage Disposal." It is a German book but there is an English translation. The states of New York, Ohio, and Massachusetts have issued considerable literature based upon adequate investigation. Several of the later works upon hygiene, such as that of Bergey, discuss the matter in detail.

There are chemical methods of treatment, irrigation methods of sewage disposal, subsurface irrigation by means of sewage, open tank methods, contact-bed systems, patented systems, several kinds of filtration systems for sewage, and various combinations of two methods. Hence, a full description would exceed our space. Certain, it is that it takes an expert to determine what is best for any given city to install. On account of its importance, we will give a little space to a discussion of sewage filtration.

Irrigation processes for sewage disposal are, roughly classed, filtration processes. Such methods have been largely used in England, and do not appear to originate contagious diseases, but the objections are many, neverthe-

less, and these methods are not much in favor, except in small places and where land is cheap and properly placed. In some of the more arid portions of the Western states, irrigation of growing vegetation has been successfully carried into effect, but no such arrangements between the cities and the landowners should be entered into without providing for proper sanitary supervision.

Intermittent sand filtration is an excellent method of sewage purification, especially after the raw sewage has been first run through the septic tank. However, it works well alone. These filters are constructed in pairs and are operated intermittently; that is, while one is operating, the other is recuperating its nitrifying bacteria, as is necessary because of the almost entire absence of oxygen in sewage. This process is well described in Bergey's Hygiene. There are various kinds of filters, inclusive of contact beds, coal filters, etc. Personal observation of the use of coal dust and even coal culm for filtration purposes gave me very favorable impressions of its usefulness. The various types of sprinkling filters have been much exploited, and I have taken an interest in following the published data concerning them, and the results impress me as irregular, although of a nature to encourage further tests.

From the thirty-ninth annual report of the state board of health of Massachusetts (1908) I wish to quote the following as the conclusions of the experts at the Lawrence Experiment Station, where for years water and sewage filtration have been especially studied. Permit me to commend to the interested reader the several reports of this station.

REMOVAL OF BACTERIA BY FILTERS OF VARIOUS TYPES

The efficiency of various types of sewage filters in removing bacteria have been discussed from time to time in the reports of the Lawrence Experiment Station, and the results of *B. coli* tests and the removal of that type of bacteria were given in the report for 1904. During 1907, in addition to the usual counts of the numbers of bacteria, as shown by agar plates incubated at 20 degrees C., determinations of the numbers of *B. coli* and of the total number of bacteria developing on litmus-actose-agar plates at 40 degrees C. in eighteen hours, were a part of the routine analytical procedure. The significance of total numbers of bacteria and of *B. coli* are well understood. The particular significance of the 40 degrees C. counts is that the majority of types of bacteria growing rapidly at this temperature have their origin in the excreta of man and the higher animals; that is, the numbers of such bacteria represent, more truly than do the usual 20 degrees C. counts, the amount of pollution in any given water.

Three methods of preliminary treatment of sewage for purification were used during the year, these being sedimentation, septic tanks, and straining through six inches of fine coal. Of these, straining was most effective in removing total bacteria. Septic action was less effective than straining, and sedimentation was the least effective of the three, the percentage removal of total bacteria by straining being 59.40 per cent, by septic action 43.80 per cent, and by sedimentation 27.20 per cent. The removal of 40 degrees bacteria and of *B. coli* by these three systems was less than was the total bacterial removal, and the relative efficiencies of the different systems was changed, Septic Tank A removing 43 per cent of the 40 degrees bacteria and 38.90 per cent of the *B. coli*, Strainer E removing 39 per cent and 34.50 per cent respectively, of these two types, and sedimentation removing 33.20 per cent of the 40 degrees bacteria and 31.40 per cent of the *B. coli*. Septic Tank F, to which sewage sludge was applied,

and which was operated with a considerable storage period, was more effective in eliminating bacteria than was Septic Tank A, which received regular sewage, the efficiency of Septic Tank F being 73.40 per cent removal of total bacteria, 58.70 per cent removal of 40 degrees bacteria and 56.50 per cent removal of *B. coli*.

All of the out of door intermittent sand filters showed a good bacterial efficiency, the average removal of total bacteria being 99.74 per cent, the least effective being Filter No. 6, with an efficiency of 99.22 per cent, and the most effective being Filters Nos. 2 and 4, with efficiencies of 99.98 per cent. The average removal of 40 degrees bacteria and of *B. coli* by these filters was 99.50 per cent and 99.47 per cent respectively, Filters Nos. 2, 4, and 306 removing 99.99 per cent of both types, and Filter No. 6, the least efficient of all, removed about 98 per cent of both types. The efficiencies of intermittent sand Filters Nos. 312 to 316, inclusive, which were located inside the filter house, were practically the same as for the out of door filters; and this was true also of intermittent sand Filters Nos. 100 and 242, which were operated with septic sewage.

Of the four primary contact filters, Nos. 175, 176, 221, and 251, Filter No. 176 was most efficient, removing 17.30 per cent of the total bacteria, 14.80 per cent of the 40 degrees bacteria and 62 per cent of the *B. coli*. Filter No. 175, operated with strained sewage, removed only 14.80 per cent of the total bacteria, and Filter No. 251 removed only 26.50 per cent of the 40 degrees bacteria and 33 per cent of the *B. coli*. Filter No. 237, operated as a secondary contact filter with the effluent from Filter No. 221, removed 49.70 per cent of the total bacteria, 49 per cent of the 40 degrees bacteria, and 56.40 per cent of the *B. coli*.

The average efficiency of the six sprinkling filters was 84.27 per cent removal of total bacteria, 87.42 per cent removal of 40 degrees bacteria and 86.59 per cent removal of *B. coli*. Filter No. 135 was most efficient, with an average removal of 95.58 per cent of the total bacteria, 96.26 per cent of the 40 degrees bacteria, and 96.13 per cent of the *B. coli*; while Filter No. 233 was least efficient, removing 67.80 per cent of the total bacteria, 77.10 per cent of the 40 degrees bacteria, and 76.30 per cent of the *B. coli*. Considered purely from a bacteriological standpoint, the sprinkling filters were far more effective than were the contact filters.

Of the three secondary sand filters operated with sprinkling filter effluents, Filter No. 224 removed 99.16 per cent of the total bacteria, 97.96 per cent of the 40 degrees bacteria, and 97.97 per cent of the *B. coli*; while Filter No. 249, the least effective of the three, removed 95.92 per cent of the total bacteria, and over 83 per cent of the 40 degrees bacteria and of *B. coli*.

Considering the various combinations of preliminary treatments and filters as systems or units, excluding the intermittent sand filters operated with untreated sewage, the system represented by Filter No. 224, which received sewage which had been settled, filtered through sprinkling Filters Nos. 135 and 136 and again settled, was most efficient, the removal of total bacteria being 99.86 per cent, of 40 degrees bacteria 99.96 per cent, and of *B. coli* 99.97 per cent. Septic treatment followed by intermittent sand filtration in Filter No. 100 removed 99.62 per cent of the total bacteria, 99.36 per cent of the 40 degrees bacteria, and 99.38 per cent of the *B. coli*. Sedimentation followed by contact filtration, as represented by Filter No. 176, removed 79.85 per cent of the total bacteria, 76.50 per cent of the 40 degrees bacteria, and 73.90 per cent of the *B. coli*, this process being more effective than straining combined with contact filtration, as represented by Filter No. 176. Sedimentation followed by double contact filtration, as represented by the 221-237 combination, removed 77.25 per cent of the total bacteria, 80.70 per cent of the 40 degrees bacteria, and 84.40 per cent of the *B. coli*, being less effective in removing total bacteria, but more

effective in removing 40 degrees bacteria and *B. coli*, than the system represented by Filter No. 176. The average percentage removal of bacteria by the various preparatory treatments, primary and secondary filters, and the bacterial numbers from which they were computed are shown in the following table:

NOTE.—The table could not be well understood unless the whole report were before the reader.

The present writer makes no pretense of being an expert in sewage filtration or the whole question of sewage disposal plants, but he has found that different engineers have varying ideas as to the best means at command. The effort has been herein made to give good and bad together and without any bias or theory to uphold. So far as patented devices or complicated methods are concerned, I confess I do not see that they offer anything better than the means long at command. Naturally, I view this matter from the medical point of view, and cannot but regard the bacterial count as of primary importance in estimating the efficiency of any method. On the other hand, initial cost and the certainty of practical operation are important factors. Surely the septic tank method *alone* does not commend itself to me except for very small plants, but when the effluent from the tank is subjected to the intermittent sand filtration process or a filter using coal, the system will be such, in my humble opinion, as will give satisfaction to any city.

A final word of caution is to the effect that the whole subject of sewage disposal is a very complicated matter, and that many of the difficulties and practical points involved have not been even touched upon in this short introduction to the subject. No city can afford to proceed to the construction of a sewage disposal plant without calling to their aid the best engineering talent. All state boards of health can recommend engineers of known ability in this work.

Under filtration, ozone purification of water is discussed; ozone also purifies sewage, and it will probably become practical to treat the effluent from sewage disposal plants by this means.

As a concrete instance of the difficulties that often must be surmounted in handling sewage, Mr. J. W. Price, chief engineer of the Atlantic City Sewerage Company, writes me as follows:

The sewerage company of this city has a more difficult proposition to contend with than has any other city probably in the world. First, we have to provide a pipe line and a pumping station with a capacity to handle the wastes of a population, in July and August, of about 300,000 people, and in the rest of the year 50,000. Other cities have to provide only for the natural increase of population.

Second, all of our largest hotels are on the dead ends of our sewers, consequently we do not have a large body of water to carry the solid matter along in the sewers as it drops into the mains from the house connections. Therefore we are troubled with a great many stoppages in the district which is caused mostly by rags and grease.

The sewage flows by gravity to the pumping station, and into a well or cesspool which is twenty-five feet in diameter and fifteen feet deep. From here the sewage is raised by centrifugal pump and forced through a pipe line a distance of about 10,000 feet into tidal water.

There is about 3 per cent solid matter and 97 per cent water.

The approximate cost of pumpage per thousand gallons is about one and one half cents. Our heaviest pumpage is in August, when our average each day is about 10,000,000 gallons. During the winter months our average is about 6,400,000 gallons daily.

During a heavy rain storm I have had the pumpage run up to about 15,000,000 gallons, caused by the surface or rain water finding its way into our system, but which is supposed to be drained off by a separate system of storm sewers. We have about forty miles of pipe line in our system.

Section VI

MINE DANGERS AND THEIR PREVENTION

CARE OF MINERS

THE history of the Spanish Conquest in America was essentially a history of mining abuses and a very dark history at that. To this day, some of the old Spanish methods prevail in parts of Mexico and South America. These methods are profitable to the operators, but take a fearful toll of human life. The miners were chiefly Indians. When gold was found in California the country was new and the miners reckless, and the procuring of proper machinery almost impossible. So long as mere placer mining was practiced conditions were as favorable as could be expected under the circumstances, but very wasteful of gold. When silver and gold quartz was discovered and stamp mills and extraction processes became necessary, the railroads were not yet built, and the pack mule and the "prairie schooner" were the only relief to human backs. Naturally, the Spanish methods of working mines were more or less necessary to suit the "get rich quick" ideas of America. All this has been unfortunate for American mining, and the hygiene and safety of mining was developed in Europe long before it became the rule here. Even to this day, some of the best conducted mines are those in China and Africa, while the unnatural horrors of the Siberian mines form an antithesis thereto. Our conditions in this country are, as yet, only average. The employment of cheap foreign labor does not conduce to ideal conditions, while sending our rich operators to Congress and blinking at wasteful methods, both serve to delay the improvements demanded by the twentieth century. But the mining states are legislating and some of the operators see profit in scientific mining, and conditions are rapidly improving.

Heat.—The deep silver mines of Nevada are as much as two thousand feet deep and the temperature rises to 158 degrees F. If the air was dry, the high temperature would not be so dangerous, but as it is, heat stroke with loss of memory and sometimes insanity is a frequent result. The deep copper mines of Michigan are not so humid and are more healthy. It is exceedingly difficult to overcome the dangers from mine heat, as it is due to the internal heat of the earth. The cool air from the surface goes down the shaft about one hundred and fifty feet and a natural draft is hard to secure, due to this and to the depth of the mine. Mine ventilating fans work by suction or by pressure and neither one is always practically available for a distance of two

thousand feet. It is impossible to lay down general rules for such mine ventilation. The power consumed by a fan runs up more rapidly than does the speed, and a very careful calculation must be made as to the many factors involved. A ventilating engineer should be employed and the hit and miss methods of engineering tables and averages should not be depended upon. Artificial refrigeration by the ammonia process is theoretically possible in deep mines, but practically does not work well. After a certain depth mining usually is abandoned. About one third of the heat imparted to air is taken up by expanding the air and starting a draft, but the friction in a long shaft is so great that this natural draft is overcome. It might be possible to force cold air to the bottom of a deep mine by means of a direct pressure blower and maintain a draft by means of two or three exhaust fans in the shaft.

Elevation.—In Utah some of the mines are three and four thousand feet above sea level, and the mining of the silver and lead there found give rise in the miners to rapid heart action and depression. The only help possible is to provide machinery to do as much of the work as is possible and thus relieve the miners. Going to and from this high elevation is deleterious and the miners should avoid frequent trips.

Dust.—This will be considered under coal mining. In mining for metals, most of the dust arises from digging and blasting, but in lead and mercury mining the dust is harmful beyond its mechanical effects and poisoning may result. These mines may be rendered more healthful by proper sprinkling. The so-called “miners’ phthisis,” formerly attributed to dust, is now known to be tuberculosis induced by the irritation from dust and generally bad hygienic surroundings.

Digging under seams.—This causes miners’ nystagmus and is particularly noted in coal mining. The constrained attitude places a strain upon the ocular muscles, resulting in spasm.

Explosives.—These should be stored in magazines at a distance from shafts and only sufficient for the work of one shift should be taken into the mine. Oils should never be stored with explosives. There is a great danger from explosives. The writer has handled high explosives to a sufficient extent to justify the opinion that the miner should be allowed to have only the common black powder supplied to them unless the mine has a suitable device for warming nitro powder. There would be fewer accidents were only a special gang of men allowed to handle nitro powder and other high-power rending explosives. As to nitro-glycerine, dynamite, and some of the special explosives, the best plan is to charge the holes (not allowing tamping bars of metal), and to fire the whole by electricity after all of the men have left the workings. This allows the escape of vapors before a new shift goes on. The worst headaches I have ever had were caused by exposure to the vapors of nitro-glycerine.

Timbering.—The timber used under ground decays very rapidly and so soon as removed from position should be taken from the mine, as it is a positive menace to health. No kind of filth should be permitted to accumulate in a mine.

Hoisting plants.—Boys or irresponsible persons, such as those addicted

to the use of liquor, should never operate the hoisting apparatus, there should always be a good indicator placed in plain view of the engineer, and a uniform code of signals should be adopted in all mines. There should be a detaching device to prevent overwinding. The two types of safety hooks known as the "Humble" and the "Akron" are considered of such importance that the Colorado State Bureau of Mines officially recommend their adoption so as to prevent the falling of cages and buckets carrying men or materials.

Fire protection should be provided for all kinds of mines, and where water is not available chemical extinguishers should be provided.

Shafts should always be provided with ladder ways, even if there is a good hoisting plant. The same should be provided for tunnels and adit levels. Shaft doors should be so placed as to prevent anything from falling down the shaft, and there should be regulations limiting the load of cages, skips, or buckets. Shaft houses should not be constructed over the collars of the shafts.

Some legislation and the maintenance of a bureau or department of the state government is necessary to secure such mine management as is indicated in the suggestions I have made under the several headings, and which are based upon existing laws. Our mining states have some or all of these matters covered by statute, and yet the fatal accidents in the metalliferous mines of the United States are about twice as frequent, in proportion to the number of men working, as they are in the United Kingdom. Just why this is the case no one seems to know positively. From what I can gather I am inclined to the view that we employ too many ignorant foreign laborers and too many inexperienced Americans. No man is safe in a mine who does not fully understand the work. Furthermore, the owners fail to do many things they should do.

Certain improvements in mining conditions are being made by the mine owners themselves. The ventilation of mines so reduces the dangers from explosive gases accumulating that it pays to keep the mines free from them. Incidentally, it is quite necessary for the health of the men that the mines be well ventilated. Drainage is another factor, being very much improved. If the mine is not too deep, the draining is accomplished by pumps. The rich Cripple Creek district is retarded very much by accumulated water below the depth practicable for pumping and the water is of a nature to corrode metal. Therefore, they are driving a drainage tunnel for a distance of fourteen thousand feet, thus opening up seven hundred vertical feet of new mining ground and a total possible depth of twenty-three hundred feet. This drainage tunnel will probably repay millions to its projectors, and will make mining throughout the whole district very much more healthy for the miners. Especially will it reduce tuberculosis, as it will not only drain, but will ventilate three hundred mining claims. This will serve as a single illustration of engineering projects becoming quite numerous in the mining field and all of which tend toward the improvement of conditions.

Dredging.—In California there are about fifty dredges in operation, and the yield in gold is about six thousand dollars per acre. Colorado has an immense area, suitable for dredging and some of which yields twenty

thousand dollars per acre. Manganese-hardened steel is opening up this field of endeavor and an important branch of industry is developing. Thus far the methods ruin the land for anything else, and a dredged area becomes a desert. Of course some of it was that before, but it is a great shame for the speculators to ruin arable land for the sake of the gold in it. Thus far there are no especial regulations restricting dredging or making any provision for the sanitary side or the safety of the enterprise.

Arsenic.—Arsenic is found in numerous ores and some native rocks, but the smelting is usually so carefully conducted that, so far as I can learn, it is not an important factor in American mine hygiene.

Mercury.—Cinnabar is a sulphide of mercury and is now mined in the United States. California has important mines and has so improved upon the wretched Spanish method of reducing the ore by roasting that the danger is reduced to a minimum. Mercury is used in amalgam extraction of other metals, but the processes are such as to save the mercury, and good ventilation reduces much of the danger. It is unnecessary to tell physicians the symptoms of mercury poisoning, but that some miners are so poisoned goes without saying. The miner should neither eat nor drink while exposed to the ore or the metal, should change his clothing and take a bath immediately upon coming from the mine or reduction works, should avoid sweating freely while at work, and should take a few weeks of entirely different work about twice a year. Thorough ventilation of mines and keeping the temperature as low as is possible much reduces the dangers to the miners.

Lead is mined in many portions of America and is often combined with silver. Galena and lead carbonate are not sufficiently soluble to constitute much of a peril in modern mining. Smelting and refining is much more dangerous. All owners of lead mines and industries understand the dangers and usually provide fan ventilation and sometimes respirators, but the men do not like them because they cannot well chew tobacco while wearing a "snout." The writer tried one on and does not blame the men, as the device is quite annoying in many ways. My own observation is that lead workers are very careless, and do not wash their hands of the dust as frequently as they should, and I believe the operators should employ some one to manicure the men's hands and nails. The dust of the mine is carried under the nails, the carbonate being quite tenacious.

Copper mines are now very well conducted, as the price of the metal is so high that waste is not allowed. The metal itself does not seem to poison the miners, but it is found in many combinations and forms, some of which are more or less toxic. Strange to say, pure copper in masses is a nuisance in the mine, as it is tough and hard to handle. Sometimes it must be cut through with cold chisels. However, the tales one reads about masses of pure copper in the Lake Superior district apply principally to the past. It was an amazement to me what a small trace of copper in rock made it profitable to mine. Apparently, at least, there was little copper in some of the ore I saw, and I noted no especial dangers. However, I am told that in parts of the West there is considerable soluble copper salts in the water about the mines, so much, in fact, that scrap iron in the water takes up so much copper that



BAD HOUSING CONDITIONS AT AN IRON WORKS

EXAMINATION OF MINORS FOR PERMITS TO WORK IN FACTORIES
New York City Department of Health

A MODEL IRON WORKS. HIGH BUILDINGS WELL LIGHTED AND VENTILATED

its extraction from the water is profitable in some places. Such mines would certainly present some danger and the water from them should not be used for drinking. It is very hard to control the men in this matter, and I have seen men scoop up water in their shovels and drink therefrom. The most dangerous work I have seen, so far as copper is concerned, is the making of brass by melting together copper and zinc. The fumes arising were out of all proportion to what one would expect.

Zinc mining I have never seen, but available literature upon the subject gives the impression that it is contamination by arsenic that gives the trouble rather than the zinc itself.

Dr. James Hendrie Lloyd, in the third volume of "Twentieth Century Practice of Medicine," gave a wealth of chemical and industrial data upon the influence of various metals and toxic chemicals employed in the arts and various lines of manufacture. Readers wishing to pursue this subject will do well to consult that volume.

Mining has its ups and downs and is too much influenced by speculation. The mine owner seems to be afraid to mine and store his product, and runs full or slack according to the market at the moment. For instance, the average price of lead in Colorado during 1907 was five and thirty-six hundredths cents per pound. In 1908 this dropped to four and twenty-one hundredths cents, and production fell off about 50 per cent. As there are over thirty thousand men employed in mining in that state, this was a serious matter for them. The result is that the men shift about from place to place, and it is not to be wondered at that many men have considerable idle time and contract habits of drinking to excess, and a small proportion become criminals, more from environment and hard circumstances than from choice. Miners' trades unions have been blamed for some of the conditions, and with some justice in certain cases, but the main and fundamental trouble is that metalliferous mining is not considered in the mere industrial light, but is manipulated in the interest of a lot of stock jobbers. That sort of frenzied mining will never make for stable conditions in mining circles any more than it did in iron production in the panic of 1907. Public hygiene is so inseparably bound up in business affairs that mining is no exception. Bad business makes bad hygiene, and this is more true of mining than of anything else. Mines closing down means that timbers rot, water accumulates, gases form, and the hygienic condition of the mine runs down to twenty-five per cent of what it would be if operated continuously. An idle mine is losing more money by being idle and depreciating than it would lose by running with the market dead against it. A proper trade adjustment, based upon normal consumption, would do more than anything else to promote mine hygiene. Let the operators ship out the criminal and useless element and run their mines continuously, regardless of Wall Street, and the miners remaining will have steady work and *the actual investor of real money* will make a fair profit, and mine hygiene will not need a chapter in a book.

Iron.—A great lesson is to be learned from the mining and manipulation of iron ore. Living in an iron and steel district, yet I feel an utter incapacity to discuss the hygiene of the iron industry in such manner as to be

of value six months after it is written. Probably the metal longest mined (unless copper be an exception) the processes are to-day undergoing such changes that the scientific study of the iron and steel industry requires a high degree of acumen and discrimination. However, we are here limited to a discussion of the mining features of the industry. That varies according to locality. Here in Pennsylvania the digging of iron ore does not involve a great degree of skill. The ore deposits are readily reached and it is principally a matter of loading and transportation. Large deposits justify the installation of machinery, but there are many ore banks in isolated localities where a siding is run in and the ore carried away, and the rails with the last of the ore. But in the making of steel, certain grades of ore are demanded and especial conditions develop. Much of our best ore comes down the great lakes and from Cuba. The appearance of iron ore is very deceptive and no one can form an idea of how hard work it is until they have loaded ore upon the cars. I tried it for the experience and found some shovels in common use took up as much as sixty pounds of iron ore at once. The ore diggers and teamsters have a very hard task and are exposed to all kinds of weather. Sickmess is common among them and their surroundings are often very bad, due to two factors. The first one is the isolation of many of the mines and the lack of the comforts of life the men and their families suffer. Yesterday I was in an iron-ore district, where no modern machinery has been installed and could not help pitying the workers. As an indication of how heavy is their work, I noted a railroad trestle carrying regular passenger traffic, but bearing a sign to keep ore cars off of it when loaded.

The ore diggers and the charcoal burners of the mountain districts of Pennsylvania are a lonely and very hard worked class of people, and it is to be hoped the primitive methods under which they work will soon give way to modern machinery and modern methods of housing and living. Another peril is the malaria so common among them. The ore is dug out and great holes remain that fill up with stagnant water and breed mosquitoes. When I was in country practice I attended many of these people and, next to the chronic malarial toxemias I have encountered in the Michigan lumber camps, these ore diggers had the worst cases of malaria I have ever seen. Large and valuable deposits of special ores are handled very scientifically and with good machinery, but too many unacclimated men go to Cuba and work at these iron mines. Fortunately the hygiene of the Cuban mines is good, from all accounts. The improvements in processes will probably bring into market ultimately a vast deal of ores very hard to work at present. Ore containing much phosphorus, for instance, is of little value, but a way will probably be found to work it successfully. I have seen great heaps of scrap iron (inclusive of burned out old stoves) worked up into structural iron, and it impresses me as strange that this material is preferred to fresh materials. The superintendent of one of the mills told me that this scrap made better structural work than they could produce from the pig. But he did not *show* me. I have been around blast furnaces and seen too much pig iron run to believe him. It tends to sanitation to have the blast furnace right where the ore is dug. The reasons are that so many men are employed as to make a

little community and improve the housing of the workers, and the slag from the furnaces is used to fill up the swamps. Fortunately, most of this slag contains sufficient sulphur to tincture the whole body of water in the swamp and prevent the development of so much malaria. Some of the best slag is worked up into a patent roofing and that makes another industry.

But more than iron ore is involved in the processes of to-day. Limestone and coke are needed and many good ore bodies are neglected, because they are too far away from these substances. Right here the big corporations are bringing economy to bear in iron production. I have seen one of them run a special railroad to connect up the ore, the coke ovens and the quarries and the railroad improved the conditions of the workers in all three places. Tungsten and molybdenum are now mined by these corporations to so modify the steel as to successfully produce high-speed tools. Vanadium steel is coming into use, while tantalum is used in the making of steel pens. Platinum, iridium, osmium, and palladium are found in the black sands of the Pacific slope, and their influence upon iron and steel are being studied. The mining of these substances, as well as of the rare earths, — thorium, cerium, yttria, and zirconium, — all tend to complicate the hygiene of mining and modify iron and steel processes as much as they have the making of incandescent and Nernst lamps and gas mantles. We know little of the toxicology of these substances. One of them, uranium, possesses radio-activity, and both uraninite and carnotite concentrates result from its refining and are used in glass tinting, porcelain coloring, and in the making of pigments. Under certain conditions, the radio-activity is thought to be dangerous. It is altogether probable that others of these substances will prove to possess harmful properties. Therefore I am much "at sea" as to the hygiene of iron and steel working. Take such a substance as coke; it being now burned in special ovens, saving the by-products. We know now that it is complex, like gas-tar, and many things result from its manipulation. So it is with iron ore. Its range of possible combination and molecular arrangement is almost infinite, and we are just in the beginning of a great development that will place its manipulation in the hands of scientists. When that is accomplished, the hygiene of the subject will develop adequately.

And this leads me to quote from literature concerning the Colorado School of Mines, the following:

We are told that when General Von Moltke dismounted from his horse at the surrender of the French army of one hundred and seventy-two thousand men at Sedan, he said, "We owe this to Pestalozzi."

When the Germans were so thoroughly defeated in the Napoleonic wars, the rulers ascribed their defeat to the ignorance of the masses of the people; then, for about three generations, great stress was laid upon education for all the people, and strictly enforced by compulsory educational laws. When the Franco-German war came, and victory rested upon the German arms, the credit was given to a well-trained, educated citizenship.

So victory in the mining fields depends upon a corps of thoroughly trained, educated men.

The day has passed never to return when a "rocker," "long tom," a few sluice boxes or slow drop, two hundred fifty pound stamp mill is all the equipment necessary to successful mining.

The electrical dredge, chlorination, cyanidation, concentration, amalgamation mills in highly specialized construction, together with the smelters, operated by men thoroughly trained, is absolutely necessary to successful treatment of our ores; while the best mechanical equipment, high art timbering, skillful sampling, exact engineering, can alone direct the present-day mining in deep shafts and miles of transportation and drainage tunnels necessary to the development of our ore bodies.

The same educated, trained, energetic men are demanded in the non-metallic mineral fields existing in nearly every county of our state; clay, sandstone, granite, lava, marble, onyx, cement shale, gypsum, petroleum, mineral waters, coal.

Thus, the question of a thorough training for the profession of mining or metallurgical engineering is state-wide, and every such man graduated from our School of Mines is a practical investment of state funds at the highest rate of compound interest.

It is just such trained men that will adequately solve the question of mining sanitation. Public hygiene is too big a question for the physician alone and the trained engineer will make possible some of the greatest advances toward the saving of life and its continuance in comfort and healthfulness.

ANTHRACITE COAL

The problems involved are partially covered in the earlier sections of this chapter. There is so much published in the newspapers and magazines dealing with coal mining that the profession and the public are pretty well informed as to the bad features of coal fields, hence, we will be brief in the present consideration of the matter. I am indebted to the Pennsylvania Department of Mines and to personal observation for what I have to say. There are about one hundred and sixty-eight thousand persons employed in the anthracite coal industry in Pennsylvania and the reports and detailed publications upon the many phases of the work are so voluminous that a mere abstract of the findings would take a small volume in itself.

To be fair to the corporate interests, it is incumbent upon me to say that there is a great deal of unwarranted criticism of the mining interests, for both these gentlemen and the very able leaders of the miners' labor union are intelligently working toward the improvement of conditions. That their efforts are not without reward is testified to by the fact that from 1870 to 1874 inclusive, there was one life lost for every sixty-seven thousand, two hundred and eighty tons of anthracite coal mined; whereas the proportion of lives lost has steadily decreased until from 1905 to 1907 inclusive there was but one fatality for every one hundred and eleven thousand and sixty-seven tons mined, and this in the face of the fact that the potential dangers have much increased, owing to the increased depth of the mines.

The labor problem is *the* overshadowing menace in the district. From sixty to seventy per cent of the men working inside the mines cannot understand or speak the English language. No one who has not visited the mines

can form any adequate idea of what a problem it is to prevent accidents under such conditions. Furthermore, the same preponderance of foreign laborers is a controlling factor in the housing conditions under which these people live.

These houses are pretty doleful places to be called homes, but I have no doubt it is true that, were good houses built, they would stand idle because the men would not pay rent sufficient to justify the investment. Some mining communities possess many homes up to the American standard, but they are tenanted principally by Americans. The proportion of foreign labor is increasing in the field in general, but there are still some towns reminding one of the old régime and in which a large number of the men own their own homes. These mixed conditions account for varying opinions, as expressed in newspaper articles. The opinion of a writer is influenced by what he sees and he may see either good or bad conditions in the coal fields.

It is exceedingly easy for well-meaning persons to wax hysterical over the conditions in the breakers and for child labor writers to present an awful array of detailed instances of boys of tender years being at regular employment, but if these same persons were to investigate boy life in the mining towns, they would have a difficult problem in deciding which set of boys were the worse off, the ones working hard in the mines or the breakers; or the boys idle, shiftless, and rapidly becoming depraved, whose parents did not lie for them so as to set them to work before they were fourteen years of age. Many of these boys go to school only when compelled to do so. I know that the state authorities stand ready to prosecute violators of the child labor law, and those trading in miners' certificates, but the persons who complain the loudest seldom make specific complaint or produce direct evidence to substantiate their charges. The whole situation is discouraging and will not improve very much in the personal opinion of the writer, until after the low groggeries that infest the region are cleared out and the union miners refuse to work in mines employing over twenty-five per cent of persons unable to read and speak the English language.

Very unfortunately, stronger races have but little patience with the weaknesses of the ignorant and degenerating ones, and the latter class gravitate towards the work easy to get. Coal mines are dirty and disagreeable places to work and our native element seek out and secure the better places and leave to the foreigner what the native seeks to escape. Long association with what we call "dagoes" here gives me some *little* understanding of them and that is all. No American seems to fully understand these people. They have their good points, but do not understand the hustling American ways, and will stand stock still and let a car run them down and seem to make no effort to get away. They will see the results of a gas explosion and next day will go on as bratticemen, with naked lamps. Plenty of them are killed by pure stupidity upon their own part. Naturally, the foremen become fatalists as regards these men and bother very little with them. It is the same thing in the iron and steel works. Number sixty-three falls into a converter, there is a little whiff of vapor and that is all; but somewhere back in Europe a family long mourn a son or husband whose letters suddenly stopped coming. I encounter these people in my hospital service and honestly try to do right by

them, but it is a trying task to *sustain* any special interest in them. Something should be done to better the conditions of these people. It seems our Christian and legal duty to help them. But *how?* Really, I cannot answer. It seems to me the primary fault is that half of Europe is not civilized as yet and is fast unloading her excess of grown-up school children upon us. It is very easy to criticise a brutal mine boss; very much easier than it is to boss a gang of "dagoes" successfully. Also, be it remarked, the average "dago" has no idea the "boss" is being brutal. As to sanitation, the bedbugs are so thick in the shanties that mere microbes have no chance. The foreign section in a mining town will begin to be sanitary when the law requires that it be burned down twice a year.

Now, these same people make pretty good farmers and do not form communities that are a sanitary abomination when they are sent West and placed at farm work. If adequate sanitation is to be obtained in the foreign section of coal towns, it will be by the construction of concrete quarters and by prohibiting the erection of shanties, wooden "boarding houses" crowded to suffocation, low dives, and dram shops, and by importing intelligent members of their own nationalities for health or sanitary officers. The native American element and some of the Americanized foreigners are no especial problem.

Gas explosions in mines are not usually the fault of the miners, except the small pockets of gas in abandoned workings into which the men wander and from which they are warned to stay away. Most of the big explosions are due to carelessness upon the part of the persons in charge of the matter. The white damp is deceptive to inexperienced men, but the bosses should locate it readily enough. Explosive gases are liable to collect in some mines and these workings require constant care. But depending upon the human element alone and ventilating fully only when men discover threatening conditions, is responsible for many accidents. A gaseous mine should be fan ventilated regularly, whether the gas has been noticed or not. The first cost of a ventilating outfit is considerable, and its maintenance is no small item, but public opinion is demanding that these wholesale mine accidents shall grow less frequent. Those accidents traceable to deficient or defective installation *can* be reduced, even if the mines are full of ignorant foreigners. Ventilation is officially reported as poor by the Pennsylvania inspectors in too many mines. Physicians and others who are interested in this subject should apply to The Green Fuel Economizer Company, of Matteawan, N. Y., for their special "Bulletin 109."

Physicians who are interested in fan ventilation generally will find "Bulletin 109" of this company very interesting. This is nearly a world-wide concern, and I have examined some of its fans, and while mechanically there is little difference in fans, these people excel in the very scientific investigation they make before installing apparatus. Mines open at both ends, as by boring through a mountain, are ventilated admirably, but I find disappointment upon the part of some parties at the failure of expensive ventilating plants. It impresses me that the difficulty lies in the inadequate surveys and the neglect of scientific data before installing the fan system. I

fear that some engineers are like some doctors; they feel that they are specialists in every line of work. As a matter of fact an engineer is just as human and as apt to make mistakes as is the physician.

It is a pleasure to record the fact that the hospital service in the mining districts of Pennsylvania is fast becoming most admirable. More hospitals are needed, but the work being done bids fair to equal that of the large city hospitals, and some very skillful surgeons are developing in these institutions. The companies are spending considerable sums upon the hospitals, and first aid lectures are given at a number of places. The Kingston Coal Company is one of a small number of concerns providing free libraries, lectures, and reading rooms for their employees. Private physicians have their own problems to face. Contract practice makes it hard for some of them. On the other hand, there are many mining communities where there would be no physician, except for the contract plan assuring a living for a practitioner.

The problem of coal culm in streams is discussed in the chapter upon "Rural Hygiene."

BITUMINOUS COAL

The report of the Pennsylvania department of mines dealing with bituminous coal mining (1907) is a book of nearly one thousand pages, and is a most depressing volume to read. It tells that the loss of life in the field with which it has to deal averages nearly five hundred per year. Let us say four hundred and seventy-five per year, and with large disasters to punctuate the whole. The Darr mine disaster resulted in the death of two hundred and thirty-nine persons. When we add to this average the annual toll of two hundred and fifty-two widows and five hundred and forty-six orphans and bear in mind that this does not include the other states mining bituminous coal, there is a gruesome total of human misery. No one regrets this state of affairs more than do the operators themselves, but business competition and the successful effort to make every man turn out more coal than was ever done in Europe, makes every colliery a part of a great machine moving inexorably on to keep the factories, railroads, vessels, and coke ovens supplied. It is like the heart that cannot stop and every year more is required of it.

The writer spent a year in the Pittsburg district and realizes that this short essay can but superficially touch upon the questions suggested. What is written upon anthracite coal mining applies here, but if anything the foreign labor question is the worse in the bituminous districts.

Bituminous coal is mined in several of the states of the American Union, and they all have legislation aimed to protect the miner. So far as I have been able to learn, such laws are very inadequately enforced and coroner's juries are usually so subservient that no blame is placed upon any one when a disaster occurs. The high seas and under ground are hard places to enforce law. I am a mere layman, but some of these laws impress me as so loosely worded that they may mean much or little just as the judge construes them.

Different states have differing laws and the operators in one state complain that they cannot compete with the men in another state if some regulation increasing the mining cost a cent a ton is enforced. It has been proposed in Pennsylvania to levy a tax of three fourths cent per ton upon bituminous coal to provide a fund for widows and orphans, and yet many of the operators shy clear of even discussing the matter. I have talked with a good many miners, and if what they say is true, coal mining is yielding very large profits. I do not wish to be unjust to the operators, but I have made it my care to write upon industries from first-hand information, and cannot but feel that there is something wrong in the bituminous coal fields. Where the injustice lies, if any, I do not know, and have found accurate information very hard to get. The anthracite men take a different attitude toward the man who asks questions, and one will unconsciously favor the man frankly admitting the deficiencies of his business.

It impresses me that there is too much machinery used inside of the soft coal mines. I do not feel called upon to specify mines, but the visitor is amazed by the dust made in the soft coal mines, partly by the use of machinery and partly by blasting out coal without undercutting. The cokers and the miners are responsible for this more than are the operators. At all events, the dust is over and around everything, and the admixture of a small proportion of gas and air with this dust all about makes a powder mine of the place, and it takes but a naked lamp, sometimes, to set it off. A flash from a blast or from an electric wire short circuiting will blow the workings to pieces with little warning. Some persons imagine that one can always tell if gas is in the mine. Nothing is more deceptive to the uninitiated. Practically the only safety consists in constant ventilation and having good fire bosses constantly on duty.

As to the dust, there is no excuse that I can see for permitting so much of it to accumulate in the mines. When it *is* there, it is absolutely imperative that it be well wet down, especially before blasting. The wetted masses of dust should also be hauled out of the mine.

Another matter is limiting flame in the workings. All safety lamps should be locked; "flameless" explosives should be used or those as near being really flameless as can be secured, electric wiring should be well erected with soldered joints, and all combustible materials should be carried out of the mine. This day's papers relate a fearful mine disaster in Illinois from hay taking fire and being neglected until the timbers were ablaze.

Many of the mines are enforcing a very excellent rule in having gangs of skilled men do all of the blast firing after the ordinary laborers and the miners have gone out of the workings. This rule should be universally adopted.

In closing this very brief paper upon the dangers of bituminous mining, I wish to say that the sanitation of mines has been discussed under previous headings and need not be repeated here. Only the special problems are here touched upon. I cannot but agree with the operators that the ignorance of the foreign laborers accounts for a large proportion of the fatalities. I have never been to see any of the Illinois or West Virginia mines, and what I have said is based upon conditions in Pennsylvania and Ohio. It is but fair to add that the "muckraking" class of writers who make a "pop call" at

some especially bad mine and who get their information largely from disaffected or liquor-eloquent men have said some unwarranted things about the operators and mining in general. Things are improving and the difficult problems of the situation must be worked out by practical men and not by theorists or by federal legislation.

(See the section upon "Oil-Pipe Lines," in this chapter, for information regarding miner's oil.)

Section No. VII

FACTORY AND WORKSHOP HYGIENE AND REGULATION

FACTORIES, WORKSHOPS, AND VARIOUS INDUSTRIES; THEIR HYGIENE, PERILS, INSPECTION, AND REGULATION IN DETAIL.

AFTER a detailed examination of the factory legislation and inspection of several states, I have concluded to detail somewhat the regulations of Massachusetts on account of the excellence of the laws of that state and the varied character of its industries. It must not be assumed that there are not other states with excellent legislation regulating factories, for there are several, but, as has been stated elsewhere in this volume, the New England states have elaborated the humanities to an extent not found in the newer commonwealths. Furthermore, the state boards of health have jurisdiction in pure food matters and in factory inspection, whereas in many of the states dominated more by political considerations (as the newer states are apt to be) these important matters are assigned to separate boards or to other branches of the state government. While many of these separate boards are doing excellent work, economy of administration as well as efficiency of service are promoted by unifying such matters under one board and one set of inspectors. It is true that boiler inspection and regulations as regards machinery and special industries such as mining, and the inspection of mines and special industries, may well be divorced from the work of a state health board; but it is also true that when pure food administration is vested in a department of agriculture, the chief concern seems to be to prevent the sale of oleomargarine; and when factory inspection is conducted apart from the health board, sanitation is neglected in favor of fire escapes. In federal affairs, a bureau of health is needed to look after some work now done under several departments.

Some gentlemen not accustomed to boards of health supervising factories will take sharp issue with the present writer. It is true there are many things to be said upon both sides, and the United States is so large a country that *local* issues are apt to cloud a *general* discussion; but a careful review of what is being done and a personal visiting tour of many and varied lines of industry leads the writer to definite personal views that, however well the separate inspection may work in certain concrete instances, it still remains true that the plan I advocate is to be preferred. It takes training to fill inspection positions and the inspectors should be under civil service regulations. It also

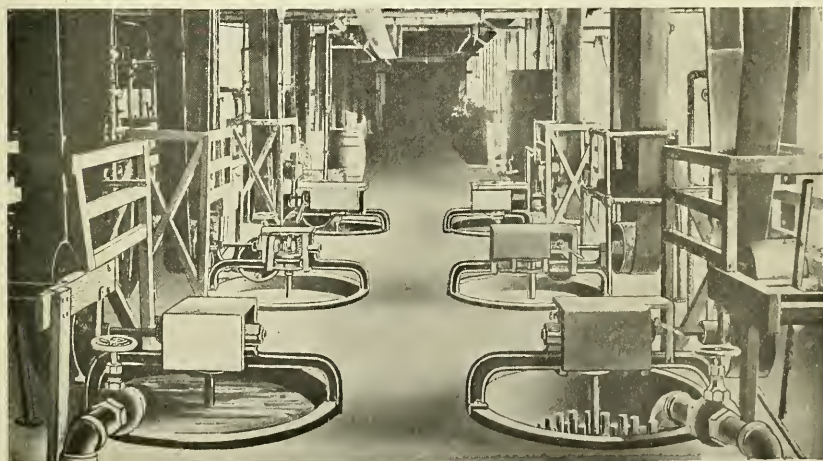
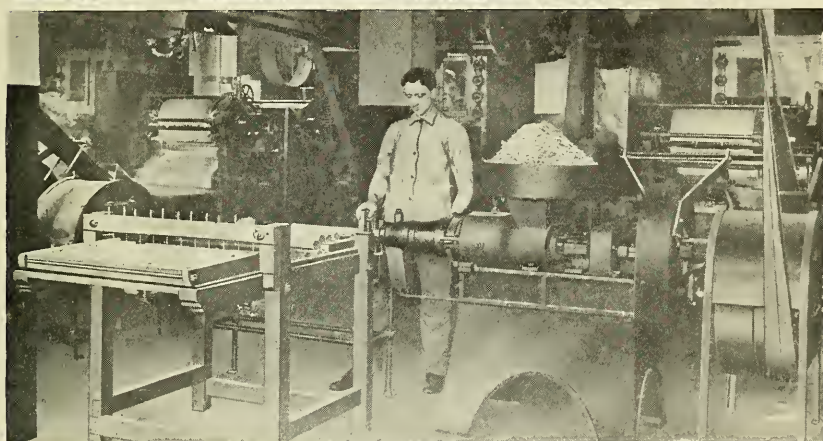
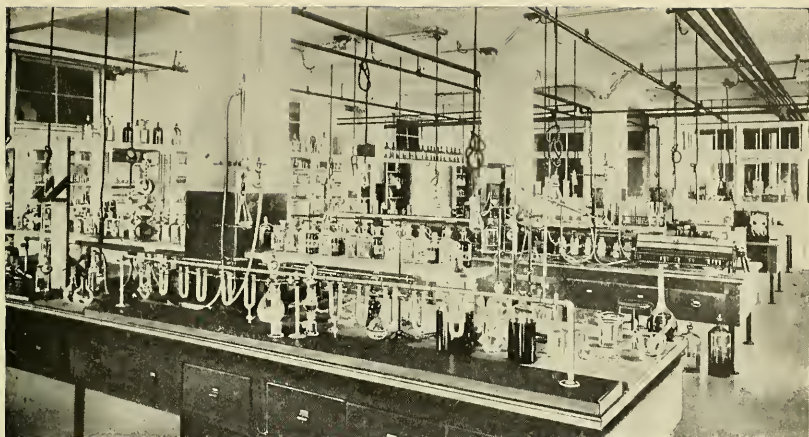
takes training to make a good head of a department. The wretched "spoils system" prevailing in most of the states of the American Union tends to eliminate an inspector when he becomes most useful to the state and most of a nuisance to the class of factory owners who desire to conform to as little of the letter of the law as is possible and to forget that there is such a thing as the spirit of the law. This class of "wealthy malefactors" I believe to be less numerous than the "muckrakers" would lead one to believe, but they *do* exist, and they are a bad lot. Nearly all of them go into politics and proceed to complain of every inspector who properly attends to his work.

The changes of administration land many well-meaning men in the executive chairs of factory-inspecting departments. They are compelled to rely upon the old clerks who are carried over from one administration to another because it is necessary to have *some* men in the office who know something about the business. Usually these men degenerate into office routinists who never see field conditions and the conduct of the affairs of the department becomes as perfunctory a performance as is winding one's watch every night. It is amazing how back number are some factory inspection departments.

In saying this, I can exonerate many factory-inspection departments from all blame in the matter. They cannot help the political system responsible for conditions, neither can they do sanitary work without due warrant of law. It is discouraging to a good official to have his work overturned, and he soon learns to let things drift along and to look to local health boards for such sanitary supervision as may be given. It also gives me pleasure to say that some of the separate boards have taken an advanced position and are doing splendid work.

Publicity is a potent factor in the improvement of factory conditions. This is markedly so with the large trusts and corporations that are so much in the public eye. So far as my own observation extends, these concerns are doing excellent work in installing safety appliances, erecting sanitary buildings, and providing for the welfare of their employees. That they could do more is testified to by the child-labor problem, and by other abuses familiar to the public. On the other hand, the small and poorly financed factories are very liable to err in several matters under the proper jurisdiction of law. This very day I saw a printing office separated from a horse stable by a board partition. The ease with which an electric motor can be installed most anywhere is a factor in causing many men to equip a small factory in very cheap and inferior quarters. It is hardly to be expected that such conditions can be adequately remedied, except by the enforcement of well-drawn laws. A mere dependence upon the police powers of the state is not enough to bring about better conditions.

Having defined my point of view, defective though it may be, we will present a short resumé of the Massachusetts laws upon the subject in hand, taking the data from "Statutes to be Enforced by the State Inspectors of



A LABORATORY IN A FACTORY MAKING FOOD PRODUCTS
 Many good firms have such equipment to protect the public
 SANITARY SOAP PLODDING MACHINE AND CUTTING TABLE
 ODORLESS AND STERILIZING PROCESS, SOAP MAKING
 Courtesy Larkin Co.

Health of Massachusetts." This pamphlet was issued by the Massachusetts State Board of Health in 1908:

Massachusetts provides for health districts to be defined, and for inspectors to be assigned to each district. In addition to other duties, they are charged with factory inspection, but have not the power to require structural alterations to be made in buildings, but shall report the necessity therefor to the inspection department of the district police.

The laws provide that all factories shall be well lighted, well ventilated, and kept clean, under a penalty for violation of one hundred dollars. Gases, vapors, dust, and other substances injurious to health that may be generated in the course of manufacture must be removed or rendered harmless so far as is possible to do, and fans or other mechanical ventilation must be installed if the inspector so directs. After four weeks' neglect of such order, criminal prosecution may be brought.

Emery wheels and belts, and buffing wheels and belts must be provided with hoods, suction pipes, and fans, or with blowers of proper size, and be run at a proper speed. Water operated grinding machines by which the point of contact is kept wet, emery wheels subject to only occasional use, and solid wheels used in woodworking establishments are all exempt from the provisions of the act. Fines up to one hundred dollars and imprisonment for a second offense are the penalties affixed.

Proprietors of factories and workshops shall provide receptacles for expectoration, and of a form satisfactory to the local board of health. No person is permitted to expectorate about the factory except into the proper receptacle. There is a long list of places designated where expectoration is prohibited, and the fine for violation may run as high as twenty dollars.

Only pure water may be used for humidifying purposes in any factory, and the fine for violation may run as high as one thousand dollars.

Water closets and privies must be provided for both sexes, and the same must be of approved sanitary construction.

Any condition adjudged a nuisance must be corrected at once. The proper legal processes are described in the act, and penalties provided for maintaining such nuisance after notification to abate same.

Foundries must be provided with adequate washing and toilet facilities of such a character that the workmen will be well able to wash and prepare themselves to appear upon the streets in a proper manner. Fines for violation up to fifty dollars.

Manufacturers are required to provide pure drinking water. They must also provide seats for women employees. A medical and surgical chest of first aid drugs and dressings must be kept in the factories, and such that meets the approval of the local board of health.

What are commonly known as "sweat shops" must be licensed and inspected, and elaborate regulations govern such places. The existence of vermin and contagious disease must be reported. Unless made in such regulated places, the garments must be tagged, "tenement made."

Our limitations as to space preclude entering at length into a discussion of various industries, but a few remarks upon the sanitary problems concerned with various trades and lines of manufacture will meet the present purpose. The meat industry is considered in the chapter upon "Rural Hygiene," as are also the dairying and creamery interests. Mining and the work of public carriers are treated of under separate headings in this present chapter. Laundries and a few other industries are considered elsewhere. (See the General Index.)

The textile industries.—The bane of this line of work is tuberculosis. Cotton and flax especially give rise to very irritating dust, and especial care must be exercised to dispose of this dust and the fibers in the air. The most recent type of picker machine used in cotton mills is a marked improvement upon the older machines and gives rise to much less dust. The regulation of moisture and the prevention of fire are two of the problems to be met in the picker room. The same trouble with dust occurs in the carding room of a cotton mill and even with modern machinery the air is hazy in these rooms. The further processes are not so dusty, but it is necessary to carefully regulate the heat and degree of moisture according to the process and this must be done regardless of the comfort of the workers. However, the modern cotton mill is so built that the rooms have a good height, are well lighted, and are painted white. The operatives are, naturally, comparatively comfortable, and keep in good health when working in such a mill. Some grades of yarn are disagreeable to weave and may be insanitary, especially if the dye used be toxic or irritating. Wool may be infested with anthrax bacilli. There are many faults noted in the run of textile factories, but it is not necessary to enter into them here. Poor light, bad ventilation, spitting upon the floor, too cramped quarters, and old-fashioned machinery are the main hygienic faults.

Cordage, gunny cloth, jute and hemp manufacture is apt to be very dusty, as is also certain kinds of carpet weaving. Silk weaving I have seen appears to be free from the objectionable features of the other materials, but it appears to me that girls are doing too heavy work in some of these factories. Except in the more recently built establishments, the lighting is poor in a large proportion of the rooms. Tuberculosis is rife in the textile industries and physicians who have a clientele among these people should keep their eyes open for throat and chest troubles. The ethical, moral, and social elements identified with the trade and the female and child labor employed therein constitute a subject of the greatest interest and importance, but so much has been written thereon and various social and labor organizations are making it their concern that an improvement may be confidently expected. From what I can learn, the abuses are not wholly the fault of the manufacturers. The reason goes as deep as the family organization and involves the anomalous sex element in modern industrial and business relations and the growing difficulty of the rank and file to live according to American standards upon the American wages, influenced as they are by competition with other nations living upon different standards.

Chemical industries.—Physicians are so well informed upon toxicology that it is unnecessary to describe the various manufacturing processes of chemical houses. Naturally, some of them are dangerous enough, but I believe that visits to a few chemical manufactories will convince any one that most of these places are taking all precautions to prevent injury to the health of their workmen.

Aside from this, many mechanical and industrial processes involve the use of poisonous substances. *Arsenic* is used as a pigment and was formerly much employed in the making of wall paper. This is less done now, but I

understand that there are yet some arsenical papers on the market. They should be abandoned. The making of artificial flowers involves the use of arsenical pigments, as do certain printing and lithographing processes, cloth printing, taxidermy, shot making, and some processes in dye houses. See what is said under mining in this chapter. Reference is there made also to *mercury* which is also used in mirror making, the manufacture of various instruments and recording apparatus, in gilding, bronzing, the making of felt hats, in the work of the furrier, and in the making of pigments. *Lead* is referred to under mining, but is also used in many industries, such as making sheet metal, lead-pipe making, making shot, type founding, typesetting, linotype casting, toy making, plumbing, painting, silk industries, lace bleaching, glass making, vitrifying, glazing, jewel polishing, paint making, calico printing, and various other industries. *Phosphorus* is used in the making of matches and rat and vermin poisons. *Copper* is largely employed in alloys, minting money and medals, brass working, many lines of metal working, the electrical industries, and very largely in the arts. See what is said under mining. *Zinc*, *tin*, and *iron* may produce toxic effects when used in solution of their salts and when melted. However, I have carefully watched zinc and tin metal coating or what is known as the making of galvanized sheet metal and sheet tin, and concluded that more harm resulted from acid vapors in cleaning the sheets of iron preparatory to being dipped and rolled than came from the metals themselves. *Chromium* and its salts are used in calico printing, bleaching fats, glass staining, in dyes, earthenware making, and a few unimportant industries. Ulcerations, purulent coryza, and other irritant effects are produced. *Chlorine* is extensively used in bleaching processes and brick glazing. *Sulphur* is used in numerous processes and many *gases* are evolved in manufacturing processes. *Alkalies* are used in soap making and more or less in numerous industries.

Chemical and physiological antidotes for these substances are sufficiently discussed in the text-books and our interest here is confined to a few precautions. Adequate ventilation is of prime importance and fan ventilation (discussed elsewhere in this book, see Index) is of great importance in conserving the health of the workmen. Dust should be prevented, the workmen should not be allowed to eat or drink in the workrooms, cleanliness and especially hand washing should be required, and the waste of these factories should never be allowed to drain into streams of water. The average factory inspector does not know sufficient chemistry to be able to give intelligent guidance to the users of these toxic agents. For instance, all physicians know the dangers of wood alcohol and yet how few of the painters and others using it know what a risk they assume? Since denatured alcohol is to be had at a low price, there is but little occasion to use wood alcohol. I cannot but believe that boards of health should have jurisdiction in such matters rather than to leave them to factory inspectors. As fish are killed in great numbers by toxic factory wastes, many states are now prohibiting the entry of such substances into streams. Even with a state board having authority to order the abatement of such practices, it is necessary for local

police powers to be enforced, and sometimes the court of jurisdiction must be appealed to before the orders are obeyed.

Tobacco industry.— I believe that it is possible to so conduct this business that very little harm will result to the operatives. There are numerous factories so conducted. On the other hand, there are a large number that are a reeking abomination. Let any one who doubts this statement go upon a tour of inspection. It is necessary to keep the tobacco moderately moist and it is impossible to make good cigars with the windows wide open in every department. The impossible must not be expected, and stripping tobacco will make an irritating dust, do what you will. Also the grinding and packing of snuff is necessarily dusty. That harm results to many persons long exposed to this dust is denied by some writers. I have personally treated too many cases of tobacco neuritis and other troubles contracted, especially by the girls working in the tobacco factories, to take any stock in the academic contentions of some gentlemen. A young person should never be allowed under any circumstance to work in some departments of a tobacco factory, however well they may be built and managed. Where the factory is properly conducted, girls may be bunch makers, cutters, rollers, and packers, and keep in good health. Factories differ. The most steady workers I have seen are the foreign women and girls employed in many of the cigar factories. These women keep in fair health because they do not dissipate. There are some factories where the girls are fast workers and make large wages, but fine clothing and making a show as well as having "a good time" dominate too many of them. The temptations of such a life are obvious.

In the factory this class of girls cannot be restrained from careless handling of the tobacco, spitting upon the floor, using saliva in tip-wrapping, and being careless along several hygienic lines. Some of the superintendents are letting the native-born girls go, and are employing the foreign women as fast as they can get them. Personal observation testifies to the fact that they are better employes, although far from ideal.

There are plenty of good cigars made in this country, and there are others. The second growth tobacco, poorly cured leaf, broken and waste tobacco, tobacco wet with sea water and even bilge water, worm cut leaf, dusty leaf, and all manner of inferior stuff is worked up. Internal revenue cuts into profits and there is a demand for cheap cigars, and I see no way of adequately controlling their manufacture. Most of them do not do any special harm and they are sold for cheap goods.

Natural leaf plug tobacco seems to be properly made, but the cheap plug goods are far from edifying to look at in process of manufacture. The unfortunate fact is that good plug tobacco will not sell to a very large portion of the trade. It must bite off readily, must not overstimulate the flow of saliva, must be highly flavored, and must be cheap. This results in cooked and soft tobacco being used, copperas being added as an astringent, and licorice to flavor and cover the taste of inferior materials. The men get what they want and what they pay for, but many would be cured of the habit if they saw it made.

Cigarettes in America are a positive menace to health. Some unprincipled manufacturers started making "doped" cigarettes, using liatris and other intoxicating weeds. This created a demand and the abominable American cigarette (sometimes blamed upon Turkey and Egypt) will increase the American mortality record for years to come. I have made up myself the best cigarettes possible of manufacture and given the same to some "cigarette fiends" under my care. I have yet to find one of this class of American degenerate who cared at all for an all-tobacco cigarette. I am well aware that certain manufacturers assert that their goods are wholly made of tobacco, good paper, and a trifle of paste. But am also well aware that under the microscope these same cigarettes show leaf that bears no resemblance to any form of tobacco leaf I have ever examined. I cannot be induced to smoke an American cigarette and the few I have tried in the past taste so abominably that it would take a great deal to convince me that they are made of undoped tobacco.

Smoking tobacco made of cigar trimmings and of scrap is cheap and usually pure, but apt to contain inferior leaf. High class smoking tobacco is often pure and above reproach. Fine cut is largely adulterated and some smoking tobacco contains alfalfa, wood pulp, and various weeds. I have examined fourteen brands of "variously cut," "granulated," and other goods of like make. While I do not care to designate brands, I was amazed at the degree of adulteration found in this class of goods. Some few are all right, but the majority are not. I have known three men who were not accustomed to smoking that sort of trash, but did smoke real tobacco in a pipe, to faint when first trying this class of goods. I have also noted that "cigarette fiends" like these cut smoking tobaccos. I am far from saying that *all* of these goods are bad, but I firmly believe that most of them are.

The reason I have taken up this matter here is because tobacco is not included in pure food legislation and could not be considered in the chapter devoted to pure food. There needs to be some federal control of tobacco products and a drastic law imposing heavy penalties upon the adulteration of tobacco. So soon as some one asserts that tobacco is adulterated, a strenuous denial is made and even chemists' certificates are published. I should like to see explained what is done with the great bales of certain weeds gathered in the South and shipped North. So much secrecy is concerned in the matter that no one engaged in the collection of these weeds even knows their names. I have found it almost impossible to get into certain portions of some tobacco factories, but some of the workmen will talk and either these men or the manufacturers at the same plants fail to understand the details of their own business or are expert "explainers." And yet no one can really prove very much. The chemical identification of tobacco presents difficulties, and the degree of adulteration of thoroughly incorporated and more or less chemically treated leaf makes one man's guess about as good as another's, and no analysis worth much. It is a peculiar trade, with plenty of honorable gentlemen engaged in it and a number of scoundrels and poisoners of our American youth.

Leather industry and shoes.—The dressing of hides presents some slight danger to health, but after leather reaches certain stages of manufacture it cannot be considered as unsafe to handle. Tanneries do not have many sick workmen. In the making of shoes and other leather goods there are processes giving rise to considerable dust and requiring fan suction to remove the same. Much of the work is hard upon the eyes and good light is necessary. Often this is not provided. Naphtha cement and wood alcohol are largely used and give rise to nauseating and far from healthy vapors. Headaches are common among the workers in these rooms. The worst feature of a shoe factory is the crowding together of machinery and operatives, and I can see no reason for it except the desire to save space. Ventilation is often very poor, and the lighting is seldom what it should be. Many of the buildings used are very old.

Food factories are considered in the chapter upon pure foods. The laws are so strict in reference to foods that most of these factories are in fairly good condition.

Hats.—Those made of straw require bleaching processes that need not be dangerous if properly conducted. Felt hats are made of fur treated with cyanide of mercury, and many of the men are poisoned by it or get very sore hands and are obliged to quit. Wood alcohol is used to quite an extent. I have not visited a hat factory since the introduction of denatured alcohol, but would think it could be used to advantage. Dust is quite a factor in the hat industry.

Comb making is a wretched job. Horn combs are hard to finish and considerable dust is made. Celluloid is so explosive that the insurance companies make the factories use blowers freely. The "rubbing" is done with ashes and is a nasty process, probably not as unhealthy as it looks. At the heating tables the girls work in a pretty warm room, smelling rather peculiarly and probably due to the camphor used in the celluloid.

The acid dip of acetic acid impresses me as most unhealthy for the workmen, and makers of good combs seldom use it. Recently casein from milk is being prepared and dried, and is used in making combs and numerous other articles. It is surprising what nice material it is.

Paper making.—I have visited several wood pulp mills and the old-fashioned straw board mills. Aside from the cooking rooms, I saw nothing unpleasant. Pulp mills are quite healthy places to work and are usually in the country and beside some stream. Recently built paper mills are not insanitary. Some of the old machinery gave rise to excessive humidity. The two factors of sanitary interest in paper mills are dust and rags. It is quite possible for rags to convey disease, especially tuberculosis. However, the mortality records of the people handling these rags is not at all high. The dust inseparable with some parts of the business did not impress me as particularly disagreeable.

Emery, carborundum, sand paper, stone and marble cutting.—These all give rise to much dust and dirt and must be classed as dangerous occupations. However, the management of most of these places provide respirators and suction or blast apparatus to carry off the dust. Many of the men refuse

to wear the respirators. These and such occupations as gypsum and cement grinding, plaster making, clay grinding, the grinding of graphite, and the making of stove polish, grinding lenses, glass cutting, cutting files, making commercial fertilizers, and many other dusty occupations are apt to give rise to tuberculosis.

Glass works are interesting places to visit, particularly window glass factories. No substitute will take the place of human blowing and it is a hard task possessed of dangers, especially to the lungs. Some of the work is very hot, but really I found less danger in the glass works than I expected to see.

Potteries, brick, and tile.—Various processes are used and by some of them considerable dust results. But these places are very open in construction and I found very little but what impressed me as well conducted.

Metal working.—There are so many manufacturing processes involving metal working that a full consideration would take a book by itself. Some work involves extreme heat and there is a great strain upon the muscles. At the top of stacks there is apt to be danger from gases, but the dangers commonly encountered are more mechanical than otherwise. Some of the older factories are not of sufficient height to provide adequate ventilation and are poorly lighted, but the recent tendency is to erect sanitary buildings as attractive as the nature of the case will permit.

Shipyards, locomotive factories, foundries, and other metal working establishments handling very heavy masses of metal present additional dangers from heavy objects falling, the use of shifting engines, electric cranes, etc., and I have noted that the raw foreign workmen do not understand keeping out of the way, but stand still, as though frozen to the spot, when they are in danger. I have thought it would be well to prohibit the employment of these newcomers in dangerous positions until after they have become accustomed to the conditions.

Rubber industries.—The first thing that impressed me is that there is very little rubber used in them compared to the bulk of the goods. In the making of ordinary rubber shoes, they use cloth, sulphur, litharge, linseed oil, tar, lime, resin, lampblack, and whiting. Incidentally, a little rubber is used, principally in the heels. Rubber tape and hard rubber goods require more real rubber. Cheap rubber hose takes very little. There is a good deal of varnish and naphtha used in the rubber industries and headaches and nausea are common.

Glue and gelatine making.—These are offensive trades and one is tempted never to prescribe a gelatine capsule again after a visit to a glue and gelatine factory. Yet if one stays long enough to see the processes, the materials impress you more favorably. It is a little like tanning; the scrapings from the hides smell vile, but the business is fairly healthy.

Soap making is another offensive trade that is not unhealthy to those engaged therein. Rendering and fertilizer making is even more disagreeable, but is not unhealthy, except when dust results.

There are many other lines of manufacture presenting so nearly the same problems as do those just discussed that it does not impress me as necessary to enter into any further consideration of the matters involved.

To those desiring to study such matters in detail, permit me to suggest reading the detailed reports of the factory inspection departments of the various states and volume three of "Twentieth Century Practice of Medicine."

Candor compels an admission. From my own inspection of various industries I am prompted to say that the saloon is an element in the unhealthy condition of many men engaged in hazardous and insanitary occupations. There is not a great deal of drunkenness while on duty, but after the mills close down the men drift into the saloons and many drink to excess. So many manufacturing towns have very little to amuse the men and the saloon is the only attraction appealing to them. The young men and girls go to dances and cheap amusements, but the older men do not care for these things. There is urgent need for looking after the health of factory operatives, aside from the factory itself. Many occupations are comparatively healthy to sober persons, but soon end the careers of those who dissipate.

Section No. VIII

Street cleaning — Garbage disposal — Some remarks upon sewers — Refuse upon streets — The question of the disposal of filth.

Municipal and other hospital administration — Charities and pauper institutions. Police and police ambulance service.

Construction: (a) bridges; (b) roads and streets; (c) public buildings and works; (d) parks and parkways.

STREET cleaning.—This question has engaged the earnest attention of sanitarians, but I find more or less variation of opinion among them regarding certain phases of the work. The average dirt street is productive of much disease, and it is strange that even in cities partially paved, the paved streets are regularly swept while the dirt streets are as regularly neglected. Upon country roads, the "split log drag" is used to good effect, and it should be used in the towns much more than it is. One can raise all manner of academic objections to it, and hosts of people cannot see how it works, but the fact remains that it *does work* and its importance in town sanitation consists in the fact that it produces a street surface that can be properly cleaned, whereas a dirt street left to itself becomes so full of ruts and holes that scraping or cleaning it is an almost hopeless task. All such streets should be gone over regularly to keep the center elevated and provide for proper drainage. City and borough ordinance should prevent depositing refuse, ashes, and offensive matter upon the streets and alleys. Every town owes it to itself, and every self-respecting citizen should insist upon his town keeping its streets *clean*, no difference how poorly they may be constructed.

"Piked" or stone surfaced streets vary so much in different portions of the country that uniform rules concerning their care cannot be formulated. That the eroded portion should be removed in order to prevent the formation of dust and mud goes without saying. Animal refuse and all manner of filth becomes incorporated with the mud or dust and it should be a matter of mere prudence to remove it. Physicians should influence public sentiment in unpaved towns in such a way as to procure streets that are at least clean.

The cleaning of paved city streets is a large problem we will merely touch upon. Various factors tend to defile them. The following clipping is from the London correspondent of one of the journals. The clipping coming to me by mail I cannot tell from what paper it is derived:

There is being made an effort to exclude horses from the streets on Sunday in October. The object of this is to show the public how much cleaner the streets could be kept if we could exclude horses from the thoroughfares. Thompson Lyon, chairman of highways committee of the Westminster City Council, is author of the plan. He says: "All the streets would be washed as usual on the night before the experiment. There would be no need to put down grit or ballast, as has to be done every ordinary morning. Starting dustless, the streets would remain dustless through the period of the experiment with no horses running.

"I estimate that horseless traffic would mean a saving to the taxpayers of London, because in addition to the economy in scavenging, the wear and tear of the streets would be infinitesimal compared with what it is at present."

In reading a book upon Holland, I noted that one of the towns in that country has long prohibited horses and cattle from entering its streets, to the great satisfaction and wellbeing of its inhabitants. While this plan could not be followed all over a city, I see no reason why it could not be adopted in the congested districts, except for certain services not conveniently performed except by horses. Were owners of horses taxed especially for street cleaning, they would soon see some merit in the London suggestion.

There has been much objection raised to the dry sweeping of the streets. Some persons have overstated the dangers, but the fact remains that it is well to be upon the safe side. All sanitarians, who possess "the saving grace of common sense" know very well, as has been brought out under railway sanitation, that tubercle bacilli are not disseminated by dust to nearly the extent some of the enthusiasts would have us believe. Nevertheless, the fact remains that *many* bacilli *are* so disseminated, and we should prevent dust so far as is possible. With anti-spitting signs in nearly every town and the public educated upon the dangers of tuberculosis, it is a question as to whether or no street sweepings contain a dangerous number of tubercle bacilli, and even if they do contain many of them, are they not killed by the light and other environment unfavorable to their proliferation? There is no occasion to become hysterical over scientific possibilities, but we do well to take reasonable views and concede a large element of danger to certain susceptible members of the community. Therefore, we should take reasonable care to prevent dust upon the streets, but should not forget that it is even more necessary to keep sidewalks clean and that automobiles raise more dust by far than do the street sweepers.

Cleaning the streets by night is a plan that works very well in some cities. The rotary brush sweepers, assisted by hand finishing are effective, especially upon cobblestone streets. Asphalt streets are well cleaned by the use of the hand brush and scraper commonly employed by the "white wings." Brick streets and wood paving should be swept.

There is a device for wet cleaning that is liked in some places. It is a tank wagon and the filling of the tank at a street service plug compresses the

air in the tank, and it but partially fills with water. This water is discharged under pressure, and at such an angle as to wash all dirt to the side of the street, to be removed by hand.

I have carefully watched street cleaning in New York city, where they have tank wagons with soft rollers precede the sweepers and wet down the streets most effectually. It is a common sight to see the wagon away ahead of the sweepers, or vice versa. The result is that there is a great deal of dry sweeping done after all. To my mind, the system is a bad one, since thousands of persons cross the streets after they are wet down and before they are swept and track the filth into stores and houses. I tried crossing the streets a dozen or more times after the wagon had passed and examined my shoe soles and found a considerable amount of matter had adhered to them. Tracking such matter into buildings will do vastly more harm than it can do upon the street. I am told that they are experimenting there in an effort to devise a better system.

After all, the best way to remove dust is by pneumatic means. Any one who wishes to see that done upon a large scale should visit the new Union Depot at Washington and watch the pneumatic cleaning of cars. A large number of railroad terminals have similar but smaller plants. Pneumatic cleaning for domestic purposes has come to stay and can be seen in nearly every small town. In some of the European cities they use this method for street cleaning, and it is found to be most satisfactory, except that some of the machinery has not yet been fully perfected. It is probably only a question of time until some such system is common in American cities.

Where dry sweeping is the rule it should be the custom to wash the streets thoroughly at quite frequent intervals. This not only cleanses the street, but also flushes out the sewers and washes sediment out of the water mains, provided, which is usually the case, a fire hose is used for the purpose. A good device consists of a length of hose with a branch coupling supplying two flattened nozzles. The hose is mounted upon a set of rollers and the outfit is carried around by one horse and operated by two or three men. They work from plug to plug and can cover a great length of street in the course of a night. In some places where it has been successfully used it has fallen into disuse because the use of filtered water makes so liberal a drain upon the contents of the reservoir an expensive item in municipal service.

The street in front of my home is of asphalt and is kept very clean. The man who sweeps or scrapes the street goes over his section several times a day. I have watched the matter carefully and find that most droppings have not had time to dry before they are removed. Using the little push cart with scoop front and dumping can, the street cleaner raises almost no dust in the routine day sweeping. If quantities of dirt are allowed to collect upon the street and remain all day, it is to be expected that the sweeping will raise a cloud of dust. It is very largely a matter of management, and any intelligent highway commissioner can figure out for his own town the best way to clean the streets. There is no *one* best way adapted to every street and to every place.

The removal of snow and ice is a problem of which the same must be said. In a very cold climate the accumulations seem to do no especial harm, but in a border climate like that of my home, the slush and dirty snow should be carted away. Breaking the ice with a bar during mild weather results in the sun disintegrating it and allowing the melting of the ice and freeing the filth so it can be carted away. There must be careful regulation of the disposition of street sweepings, the men should not be allowed to sweep matter into the sewer openings, the sidewalks should be kept as clean as are the streets, no paper or peelings of fruit should be thrown upon the street and no one should be allowed to expectorate upon the sidewalk.

Garbage disposal.—Garbage does not include sewage, but in the municipal sense the same contractor collects garbage, ashes, and refuse in most cases. I find it would require space beyond the present limits to enter into a discussion of the methods of the disposal of these substances, followed by various cities. In general, two methods are followed. By the first, the city collects such garbage and refuse as may come under its regulations; by the second plan it is done by contractors selected by the city. Numerous controversies follow both methods. Many hotels claim the right to dispose of their own garbage by such methods as appeal to them. As a matter of fact, broken food has a market value and can be sold by the hotel or restaurant, while ordinary garbage is sold for the fattening of hogs. Some contractors have claimed that all such substances belong to them under their contract with the city and they wish to collect it and sell at a profit to themselves. Dead animals are another literal "bone of contention," the owners claiming the right of selling them to rendering works or phosphate factories. Many factories have large quantities of refuse material of a certain value; for instance, brewery and distillery waste, slaughter house refuse, the waste from canning factories, etc. Naturally, they claim the right to dispose of it in a sanitary manner, usually with profit to themselves. Some of the contractors have ordinances passed by friendly councils denying the right of filling one's own lot with clean ashes or requiring householders to carry out of their cellars and deposit in specified containers the furnace ashes, while the householder objects to purchasing so many containers and prefers to get his ashes hauled away when a cartload accumulates.

Separating various substances is another matter that produces friction. To illustrate, the law requires that in my back yard I have three containers properly covered. One is for garbage, one for ashes, and one for refuse. Mixing the ingredients subjects me to fine while the contractors collect garbage twice as often as they do refuse. Green corn is in season and the collector fishes the corn cobs out of the garbage can and places them in the refuse can because corn cobs will not go through their machine successfully. Naturally, the cobs become offensive before the refuse is called for. Cherry seeds also bother the operators of the machine. The custodian of a public building heated by a public steam plant and where no cooking is done finds that neither wagon wants the cigar stubs, waste paper, and floor sweepings from the building.

All this is stated to show the complications that arise when a contractor

is charged with the removal of garbage. And there is another count against that system. It is very natural that the contractor wants to make a profit from his contract; so he erects a garbage disposal plant that uses the steaming and tank method and converts the garbage into fertilizer that he sells at a profit. One cannot blame him in the least, but this method results in a horrible stench, no matter how careful the workmen may be. As the city grows toward the plant, the people complain of the odor, but the plant was there first and erected by direct permission of the city. I am well aware that the exploiters of these plants claim there is little if any odor. But go and see, or rather smell. Theoretically, they can be run with very little odor, but practical operation is another matter, just like it is with large municipal sewage treatment plants.

Where cities collect the garbage themselves the same objections apply in part, but the incineration method is more apt to be followed, because the city is not trying to make a profit out of its garbage collection. Persons who wish to read the details of garbage disposal will find it profitable to procure the "Transactions of the American Public Health Association" for the year 1901. Read two papers therein, one by H. W. Hill, entitled "Refuse Disposal in Boston," and the other by W. C. Woodward, entitled "Refuse Disposal in the District of Columbia." The 1903 report of the same organization has an elaborate résumé of the matter, based upon the experience of several American and European cities using different processes. It will pay any city physician to read these papers in detail, but it would require much space to enter into details that I fear would not interest most readers. Permit me to quote the conclusions reached in the 1903 report:

Separation of waste materials is neither economical nor desirable, the cremation of mixed refuse appears to be the most generally satisfactory process, and this cremation may be best accomplished in furnaces of the English type.

The data upon which these conclusions are based are so elaborate that they can be well accepted. But it must be conceded that whatever defects may inhere to any system of garbage disposal, it is far better than is no system at all. The problem in its rural aspects is discussed in the chapter upon "Rural Hygiene" (q.v.), but emphasis must be placed upon the fact that in both rural and city systems flies must be kept from garbage, as they will breed in it just about as well as they will in a manure heap. Incidentally I believe that manure should, in the city, be regarded as garbage and be removed at least once a week from all premises containing it. The old idea that the ammonia of manure is healthy is absurd, but "it sticks" to just that extent that it is very hard to get people to realize what an essentially filthy and dangerous substance it is of itself, while as a breeding place for flies it is one of the most objectionable and insanitary of substances. I place no reliance at all in regulations requiring that manure be covered or be treated with antiseptics. I have watched the operation of the covering ordinances and have yet to find any place where they are anything but a mere farce or even where the matter receives *intelligent* attention.

Some remarks upon sewers.—The limitations of this present book preclude the general considerations of sewers. It is true that there would have been little trouble in securing an engineer to write a section upon the subject, but to have done either himself or his subject justice would have required large space. It impresses the present writer that we can well leave the construction of sewer systems to the sanitary engineers and say little about it here.

However, there is not one of our cities but has its sewer troubles largely due to the fact that there is much old construction they cannot afford to tear out or there was miscalculation as to the growth of certain portions of the city and the present sewers are inadequate. It is a hopeless task to estimate in advance just where the growth of any city will be greatest and the city engineers can do little but guess as to the proper size of any specific sewer. Therefore, we should be slow in criticising any of the officials having to do with sewers. In addition, man cannot make grades just to suit the cities, and there is a very stubborn set of facts outlined in the state surveys and the hydrographic reports that are a nightmare to the engineers. Here in Harrisburg, we are wanting to construct an intercepting sewer for about two miles along the river front. Now the fact is that, despite a strong current in the river due to volume of water, initial velocity and rapid fall down stream, the river actually has a grade here of very little more than one foot to the mile. Give a sewer such a slight fall and one will have trouble at once. Again, while buildings are reaching up into the air they are going three and four stories *below* the street. How will those basements connect with sewers? There are different kinds of soil requiring differing construction and endless difficulties with rock in narrow streets lined with buildings that will not stand blasting near the foundations. Some trenches fill with water faster than it can be pumped out, some soils cave in, some contain quicksands water and gas pipes, and all sorts of conduits may be in the way of the excavations, railroads block the line of the sewer, or there is a very high tide where it should be discharged, or there is no stream within miles and no available place to put a disposal plant. The troubles of the sanitary engineer are endless. Your town may need a twelve-inch sewer and it may be a very simple matter to place it, using ordinary sewer pipe, but Baltimore is at present building several sewers large enough to admit a double team, and they will empty into three disposal plants. I have at my side the *Engineering News* for July 22, 1909, and in it is a description of the Chicago drainage canal, and the problems involved — problems so large that it has taken millions to solve them and some questions remain unanswered yet (by the courts) while engineers are nearly devoting their lives to this one project. It might do physicians good to read some of these engineering journals. Just take this drainage canal; it took eight tons of dynamite per day to blast out the daily twenty thousand cubic yards of stone excavated for a long time, and there has been three million cubic yards of dredging done. The final channel is to discharge six hundred thousand cubic feet per minute where was once a little river that in summer time could discharge its total flow through a sixteen-inch sewer pipe. This large flow will fill a large canal twenty-two feet deep and constitute a sewer with the sewage therein so diluted with clean water

that it will be as pure as is the water of many streams not called sewers. The approximate cost will be about thirty-five million dollars — and this for a sewer! Do you wonder that the present writer felt it beyond the limits of this book to pretend to enter upon the engineering features of the great sewage problem?

But we *can* understand the results upon public health. Chicago had thirty years ago a death rate sixty per cent higher than it is to-day. It is the same city with the same climate and the same location, only vastly more people; but it spent one hundred million dollars for a pure water supply, it raised the city grade itself in order to secure drainage and actually lifted up its houses high enough to put sewers under them, it opened parks, it established baths, and it is completing the greatest sewer in the world. Since 1891 its typhoid death rate has fallen ninety-one per cent. That means that during this period seven thousand one hundred and twenty-seven persons were saved from death by typhoid in this one city because of public sanitation. And if one does not regard saving life as profitable, he may be influenced by the statement that this canal will develop one hundred and forty thousand electrical horsepower and has turned the Illinois River into an important fish-producing industry.

All this makes me almost ashamed to have placed sewers under the heading, "Minor Public Works." However, as the physician is involved in the outdoor sewer question, it is a minor one in our present study. Under the section upon "Plumbing" in another chapter, nearly everything is said about sewers that really influences the work of the physician. The engineer has his place in sanitation, and a most important place it is. We can leave to him and to his books the rest of this subject.

Refuse upon streets.— Building operations, sidewalk vending, the shipment and unpacking of goods, the detritus left by crowds, waste materials from factories and other concerns in business, waste paper and a general assortment of many things are found upon and litter up the city street as well as making it insanitary. As a rule, street cleaners are not sufficiently charged with the removal of such matters. Waste receptacles upon the corners, an anti-handbill ordinance, training the children in school to be neat upon the street, preventing inflammable packing to be allowed where it may be fired by some careless smoker; all these things promote both sanitation and safety.

The question of the disposal of filth is a very large one, covered under many headings in this book. To my mind, our American system is defective and does not bring sufficiently good results. Notwithstanding our democratic form of government, paternalism in many things is the rule. This is notably the case with public health administration. Perhaps it is necessary in a new work and will the quicker bring good results. But what of the future? The weight upon the taxpayer is already heavy and is daily becoming more so. The public is being trained to expect good sanitary conditions, and takes them as a matter of course. Here, they also expect good public schools, but any man owning a fair share of property pays more in school tax than would keep his children in private schools, while the great majority of the public simply pay a slightly increased rent toward the education of their own

children. The plan seems to work out well, but if the same plan is extended to cover many other things, there will be a breaking point reached in taxation. I live in a city that has adopted the plan of making extensive municipal improvements, such as filtration of water, sewage disposal, large parks, etc. While it has certainly improved the city, R's taxes have considerably more than doubled within the past four years. Beside that, he has paid a considerable sum for street paving, but does not regret it. It is fair that he should pay for these things, and it would not be fair to place upon the wage earner the improvement of R's street, while his less prominent one is still a mud road. And, in the long run, R's places will so increase in value that the increase is a cheaper investment than is life insurance and will amount to the same thing. In other words, the increased taxation is like paying life insurance premiums at a low rate. In this view of the case, the sanitary improvement of a city (and making it sanitary tends to make it beautiful), pays in dollars and cents the owners of well-placed property therein. The argument is, therefore, that these property owners should pay for the improvements and sanitation benefiting their holdings. If a street is paved, the abutting properties should pay for the same; if a sewer is laid, the same should be assessed upon the frontage; if a municipal filter is constructed, the water should be sold by meter and at a rate to gradually lift the bonded indebtedness; and if a park is opened and contiguous property is benefited thereby, there should be laid upon that property a portion of the cost. By such a plan, the general taxation can the better care for such matters as intercepting sewers, public buildings, fire protection, etc.

Bringing this down to the question of the disposal of filth, the argument would be that a hotel with a couple hundred bath rooms and the department store with a dozen elevators and a score of lavatories, should pay for the disposal of its waste and not place the burden upon the small taxpayer with a minute comparative interest in the matter. It can be no hardship upon the well-to-do class to require of them that they personally pay for the disposition of the waste matters upon their properties. When the same men build a rural home they expect to expend considerable sums upon the sanitary arrangements of their buildings and grounds. Why should they expect the people of the township to dispose of their filth? Conversely, why should they expect the city to undertake for them very much more than it does for the run of its citizens? Usually these large properties are assessed at a lower comparative valuation than are the small homes of the workmen, and, dollar for dollar, pay less tax. Those who use the roads should keep them in repair and those who make large use of the sewers and water supply should pay for what they get. As municipal sanitation increases, it will become necessary to readjust the cost thereof, else our cities will become places where the average man cannot afford to live. The sanitary systems should be made more self sustaining.

Municipal and other hospital administration.—This will be touched upon only as it regards public health. Dr. A. G. Gerster, of New York city, presented some few years ago, in the Medical Record, arguments

against the American form of hospital administration. An abstract of the paper, from the Journal of the American Medical Association is here given:

7. *American hospital economy.*— In analyzing the conditions which underlie the extravagance and waste in hospital management in this country, Gerster emphasizes the necessity for more active participation in the executive control by the members of the hospital staff. The plans or organization of the great hospitals of Hamburg, Berlin, Vienna, and Budapest are described in detail, the essential features being that the position of the lay superintendent of American hospitals is occupied by one or more salaried medical directors, the attending staff is very limited, so that the service is a permanent one with salaried visiting physicians and surgeons, and the house staff also is composed of paid assistants, whose positions are permanent. In this way all those concerned are able to give the necessary time to details of economical management, and also acquire the experience necessary to carry them out with effect. The present plan of conducting hospitals here resembles that in use in medieval Europe, and the author predicts that sooner or later a system similar to that now employed in Europe must be adopted.

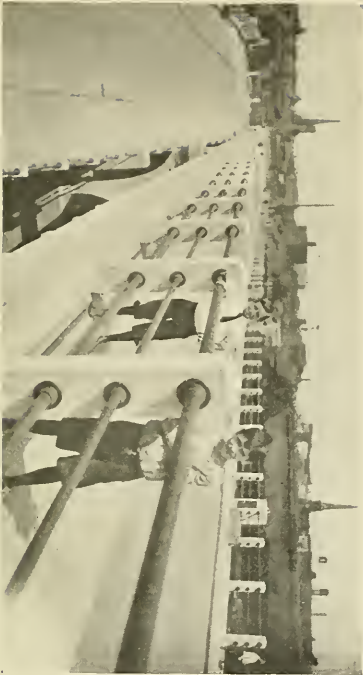
Such a plan would eliminate many of the present American hospital and dispensary evils. There would be no more charity hospitals than are actually needed, they would tend to be under municipal or board of health control, and the charity features would not be so much abused as they are at present, the people able to pay would be made to adequately pay for professional services, uninformed laymen would not run hospitals as a fad, private hospitals conducted by physicians would be able to live, young physicians would not be robbed of their legitimate business, there would not be a constant effort made to secure legislative appropriations for hospitals having little excuse for being, money would be saved, clinical teaching would improve, hospital service generally would improve, and (what is seriously demanded) the health authorities and the physicians would be brought more together than is the case to-day. Municipal hospitals are discussed under several headings in this book. (See the General Index.)

Charities and pauper institutions.— Chapters IV, V, IX, XI, XVII, XIX, and the article upon the New York City Department of Health, all take up phases of this work, and some reference is made to it in Chapter XXIII, under Inspection of Immigrants. (See the General Index.)

Police and police ambulance service is discussed in Chapter IV. There is a growing tendency to use the police in works of mercy and humanity, and therefore a growing necessity to appoint as policemen men who will properly adapt themselves to the new conditions. Police service is rapidly becoming specialized, and one hears much less of police brutality than was formerly the case. The police is rapidly becoming an important factor in public health.

CONSTRUCTION

Bridges.—At the time of the Johnstown flood in 1889, I learned two lessons about bridges. As I stood upon the stone arch bridge of the Pennsylvania Railroad and saw the immense mass of wrecked houses and their contents that were piled against that bridge, and it stood firm amid all the



TWO VIEWS OF NEW YORK CITY DOCKS
TWO VIEWS OF A MODERN CONCRETE BRIDGE

frightful wreckage, I could not but be impressed with the wonderful strength of modern bridge construction. The other bridge was wrecked because it was of the flimsy iron construction so common when American iron was cheap. The illustrations of the concrete bridge accompanying this article are of a structure displacing a large iron bridge newly erected, as I remember it, less than thirty years ago, but worn out and condemned within that time. Above Harrisburg is an immense four-track stone and concrete railroad bridge. Hosts of people crossing it in the trains never realize that they are upon a bridge, as there is no reduction of speed and the sensation is the same as upon solid land. Well-made concrete is wonderfully strong, and the steel reinforcing used is so well protected from the elements that the metal has a vastly increased life.

In Washington, New York, Chicago, and other places, similar construction has already stood for some time and gives every evidence of wearing, as predicted by the engineers. An advantage of this kind of bridge is that it can carry a good paving. Probably the most insanitary of bridges is the old style covered wooden bridge. It is a rare event for their floors to be cleaned of the accumulated dust and manure. I have seen droves of cattle and sheep crossing such bridges raise so much dust that at two hundred feet distance they became invisible. Many wooden bridges have barrels distributed along them and filled with water for use in case of fire. Unless well covered or chemically treated, these barrels breed hosts of mosquitoes. Tight covers should always be fitted to such barrels. Concrete bridges should have proper sewer connection wherever possible.

Roads and streets.—This is a large question we can merely touch upon in this present consideration. There is so much literature upon road making and maintenance that there is no occasion for lack of information of a far more skilled character than the present writer can give. From the sanitary standpoint, good drainage and cleanliness are the points of interest. The automobile having become so great a factor, it is becoming necessary to build roads that will carry less dust to be stirred up by every passing machine. Limestone and other soft stones make very dusty roads, while trap rock does not disintegrate so readily. Various mixtures of material are suggested for road making, but it is not necessary to discuss them here. It is largely a question of soil and available material, at any rate, and few communities can afford the fancy processes. Intelligent use of what already exists would improve most of our roads, and at least make them sanitary. Oiling the road appeals to me as a sanitary measure of some value and I have seen it work out well in practice. (See "Street Cleaning," in this section.)

The competition among paving companies is very great and one finds difficulty in securing unbiased information as to the real value of the various kinds of street paving. As the matter impresses me, we have first of all some disadvantages to overcome. In my remarks upon gas plants I took occasion to direct attention to the killing of trees by leakage from gas mains. Where there is an impervious paving, this is aggravated, and a leaking main may vent into the cellar of a house through a soil more pervious than is the street surface. The remedies are to construct good gas service mains, to leave

unpaved areas around all trees, to use pervious brick sidewalks or narrow ones of cement with grass plots along them, or to build all houses back from the street line and maintain lawns in front. It cannot be denied that horses slip upon a paved street more readily than upon an ordinary road, and while they soon learn how to take the paving, it is not good practice to pave with asphalt a slope that is at all steep.

The most important matter in the construction of *any* paving is the foundation of concrete. Its depth must be determined by the latitude, the character of the soil, and the wear the paving is apt to receive. To see wood paving blocks laid upon four inches of poor quality concrete is to foresee the failure of wood paving in that town; while six inches of brownstone concrete under asphalt is wasting good asphalt. Such soft stone should never be used in paving. The making of the concrete and the quality and amount of cement used are important matters usually neglected. Any of the approved pavements will give good service if well laid upon a proper concrete foundation, while none of them will continue to do so if the foundation is poor. Agents and committees can throw all the dust in the municipal eye that they have a mind to, but the above statement can be verified by examining the pavement of any city that laid it as much as five years ago.

The next important matter is the supervision of the work. It will pay any city laying asphalt paving to have a real expert to inspect every load that goes into the work. Overheated or twice used asphalt cannot make a good pavement. Burned asphalt soon disintegrates, while good material rolls down under the wheels of traffic and improves for some time. Automobile oil and coal oil will cut the surface. Brick should be of a make tested and tried. They should be hard and not chip at the edges too readily and be of a form to bind together and form good joints with cement grouting. Too resonant a brick makes a noisy pavement and the courses should be broken at intervals with earth or strips of wood, so as to break conduction of sound. No hollow places should be allowed under them, without a good layer of sand intervening to absorb sound waves. Creosoted wood blocks are apt to be slippery if improperly laid. If they are imperfectly treated they swell during wet spells and either buckle up or break the curbing. A good plan is to cover them with a thin layer of asphalt floated over hot. Tar roasts out in hot weather because it is usually of a lower melting point than is asphalt. Asphalt blocks need a very good foundation, as do also Belgian blocks. Laid upon earth or sand without concrete subjects them to the action of frost.

Public buildings.— This subject is discussed in the concluding section of Chapter II.

Parks and parkways.— See Chapter VI.

CHAPTER XXIII

PUBLIC CARRIERS AND SANITATION*

Laws regulating — Railroad sanitation under the following sections (Car sanitation — Tuberculosis in cars — Car disinfection, etc.— Car ventilation — Railroad freight — Railway mail service — Express cars — Carriage of the dead — The Pennsylvania Railroad-system of heating and ventilating cars.)

Trolley, elevated, and subway lines.

Docks and harbors — Shipping regulations — Sanitation and safety of passenger vessels.

Inspection of immigrants.

Carriage of animals from infected ports and sections.

LAWS REGULATING.—Nearly all of the states of the American Union have more or less regulation of common carriers. Usually, the laws are directed to public safety and not very directly to sanitation. It may impress the conservative East as rather strange that the writer of this paper was obliged to seek in the West for a model law governing the sanitary operation of railroads. We are appending hereto the rules and regulations of the state of Texas, and would add that Chapter II, upon Public Buildings, makes further reference to the sanitation of depots and offices :

RAILWAY COACHES AND SLEEPING CARS

SECTION 1. Employes of railway companies shall pay proper attention to ventilation, and shall promptly warn all persons who spit on the floor or otherwise befoul the car in which they are riding. They shall also inquire concerning any case of sickness which they may notice, and determine as best they can whether it is a contagious or infectious disease, and if found to be such, the health officer at the next stop may be appealed to for the purpose of caring for the disease as seems best.

SEC. 2. Each day coach used for passengers in this state shall be provided with one cuspidor for each seat or every two chairs, and one in each smoking apartment; except that in each parlor car there shall be as few as one cuspidor to every three seats, and two cuspidors used in the smoking apartment; in each sleeping car shall be placed one cuspidor to each section and three cuspidors in the smoking apartment, one of which cuspidors shall be an unusually large one placed near the wash basin for use in washing the teeth; each cuspidor in every car used for passengers shall contain not less than one third of a pint of an approved disinfectant solution, and the cuspidors shall be emptied, washed in a similar solution, and replenished each trip or every twenty-four hours.

SEC. 3. Day coaches shall be thoroughly cleaned at the end of each trip, and in no instance shall the day coach go uncleaned longer than two days when such coach is in use: the thorough cleaning of day coaches shall consist as follows:

(a) Windows and doors shall be first opened and the aisle strip, if there be any removed from the car.

(b) All upholstery shall be dusted and brushed, using compressed air whenever possible.

*By several contributors.

(c) The floor shall be mopped or swept after it has been sprinkled with an approved disinfectant solution; and after cleaning thus, the floor must be scrubbed with soap and water, to which soda-ash or like cleansing agent might be added.*

(d) Closet floors and walls must be cleaned by sweeping and washing and wiping with an approved disinfectant solution, and urinals must be thoroughly cleaned and disinfected with same.

(e) All arms of seats, panels between windows and window ledges, windows, doors, and door knobs must be washed with soap and water, to which a cleansing agent may be added.

(f) Water coolers must be emptied and scalded once in each twenty-four hours, and shall be filled with good and wholesome drinking water when in service.

SEC. 4. Sweeping is prohibited while train is in transit unless floor of car is sprinkled with sawdust wet with an approved disinfectant solution to thoroughly keep down the dust.

SEC. 5. Parlor, buffet, and dining cars must be cleansed at cleaning terminals, as set forth in Section 3 of this chapter. Carpets and draperies to be removed, dusted, sunned, and aired. Food boxes, refrigerators, closets, drawers, and cupboards to be cleansed, scalded, and treated with a solution containing two per cent absolute formaldehyde, or such other disinfectant as the state health officer may approve.

SEC. 6. Day coaches must be thoroughly disinfected in the manner described in Appendix A of this circular, or by such other method as the state health officer may approve, immediately after any case of contagious or infectious disease, as defined by Appendix C of this circular, is discovered on board of said day coach, and also every day coach must be disinfected by said method on being sent to the repair shop for any cause, and before same is readmitted to service.

SEC. 7. Every sleeping coach operated in the state of Texas shall be cleaned at cleaning terminals according to the methods set forth in Section 3 above, at least once each week; and must be disinfected at least twice each week, except coaches which are used in a continuous trip for more than three days, and such shall be disinfected at the end of each run, and in no instance shall such a coach be used for more than eight days without disinfection. Said disinfection shall be done according to the method prescribed in Appendix A herein, or by such other method as the state health officer shall approve; and all blankets used in sleeping cars must be thoroughly washed at least every ninety days.

SEC. 8. Every day coach, parlor, dining or sleeping car operated within this state shall be provided with adequate and efficient appliances and equipment for ventilation, and it shall be the duty of the owners, operators, and employees to provide the best possible ventilation at all times that the said car is in use.

SEC. 9. Ice which is used in water coolers in cars must not be dumped on floors, sidewalks, car platforms, where people have trod and expectorated, and then picked up by unclean hands and put into the drinking water. It must be washed and handled with ice tongs.

SEC. 10. Passengers, patrons, employees are prohibited from washing their teeth or expectorating in basins in sleeping cars or passenger coaches in this state, and near the wash basins in each coach shall be conspicuously posted placards with the following inscription printed thereon: "Passengers and employees are prohibited, by the laws of Texas, from washing their teeth and expectorating in wash basins."

Large cuspidors shall be provided for such purposes, as indicated in Section 2 of this chapter.

*It is preferable to sprinkle the floor with sawdust saturated with an approved disinfectant before sweeping.



INTERIOR SANITARY DAY COACH
Northern Pacific Railway Company

The seats are readily removed from the car for cleaning and disinfection, metal work is reduced to a minimum, and other inside finish and trim is of a character to withstand the frequent application of disinfectant washes, the lighting is electric with gas in reserve, the floor is watertight, so as to be readily scrubbed; toilet arrangements are in a vestibule, and windows, ventilators, and ceiling vents are so constructed as to seal tightly for formaldehyde disinfection.

SEC. 11. On each sleeping car operated in the state of Texas a fumigation record must be kept and preserved, and on same the following records are to be entered and kept, viz.:

1. Date of each disinfection.
2. Length of time devoted to each such thorough disinfection.
3. Each item in said record shall be inserted immediately after each act recorded, and the signature of the person or persons doing said cleaning or disinfection must appear beneath the said records.

This Texas list of regulations is based upon legislation, providing adequate penalties for violation. I am perfectly aware of the fact that certain railroads have very sharply taken Texas to task for its stringent regulation of corporations, but it may be interesting to note that the greater criticism has been upon the part of corporations which *do not* do business in Texas. That the regulations of Texas are practicable I prefer to demonstrate by reference to a railroad outside of that state, and that has provided regulations so nearly paralleling those of Texas as to suggest that other states may not fear to follow in the wake of Texas in this regard. This reference will appear later in this paper.

As an illustration of the fact that the laws of most of the states, so far as they relate to railroads, provide for public safety we will instance the law of Maryland:

RAILROADS

Public General Laws, 1888, Art. 23. 1886, ch. 294, sec. 1

194. Whenever the several railroads of this state, operated by steam, shall cross any public highway at grade outside the corporate limits of cities, and any such highway shall be believed to be of such a character as to render the passage of locomotives and trains thereon dangerous to life and property, it shall be the duty of the commissioners of the county in which such point of crossing shall be located to notify the company owning or operating the railroad as such point, by serving a written notice on the superintendent or other agent of such railroad company in said county, that the said county commissioners will, in thirty days thereafter, consider the necessity of further protection against danger at said crossing; and if, after the expiration of said thirty days, said county commissioners, or a majority of them, shall determine that such protection is necessary, they shall notify said railroad company, through its superintendent or ticket agent in said county, that within sixty days thereafter said railroad company shall either place a flagman at said crossing, whose duty it shall be to give timely notice to all persons using said crossing, of the approach of all locomotives or trains, or a system of electric alarm bells, to give such notice at the approach of trains, or shall erect safety gates at said crossing, which shall be closed not less than one half minute before the passage and during the passage of every railroad train or locomotive across said highway; or shall change the said grade crossing so as to pass said highway with an under or over grade crossing, in which case neither a flagman nor safety gates shall be required.

Ibid., Sec. 2.

195. If any railroad company shall neglect or refuse to comply with the requirements of the said county commissioners as provided for by Section 194, said railroad company shall be liable to a fine of twenty-five dollars per day for each and every day it shall neglect or refuse so to do.

Ibid., Sec. 3.

196. It shall be the duty of said County Commissioners to enforce the payment of fines imposed by the preceding section, as other fines are collected before the Circuit Court for said county, and the state's attorney thereof shall attend to the prosecution of all such suits when directed so to do by the said county commissioners.

STOPS AT STATIONS

Article 23, Rev. Code, Public General Laws of 1888

SEC. 179. Every railroad company in this state shall cause all its trains of cars for passengers to entirely stop upon each arrival at a station advertised by such company as a station for receiving passengers upon such trains, at least one half of one minute, and every company, and every person in the employment of such company, that shall violate, or cause or permit to be violated, the provisions of this section, shall be liable to a forfeiture of not more than one hundred nor less than twenty dollars, to be recovered in an action of debt, upon the complaint of any person before any justice of the peace of the county in which such violation shall occur, and in all cases in which a forfeiture shall occur under the provisions of this section, the company whose agents shall cause or permit such violation shall be liable for the amount of forfeiture; and in all cases, the conductor upon such train shall be held *prima facie* to have caused the violation of this section which may occur upon the train in his charge; said forfeiture to be recovered in the name of the state of Maryland, for the use of the common schools.

Such laws usually work out fairly well. Pennsylvania is trying the doubtful experiment of placing the railroads under a state commission, the members of which draw large salaries. I have taken occasion to ask the opinion of railroad men about this commission, and they smile a very inscrutable smile. The commission is too new to criticise but, from what little is told me, other states will do well to wait a while and note how it works out here. The fundamental idea is undoubtedly right, and as well based as is providing a commission of mining, but the fact remains that the railroads are so near to the whole public that public opinion regulates them automatically. The public does not ride mine cars and rarely interests itself in mines.

The Interstate Commerce Commission and the Sherman Anti-trust Law, as well as numerous state acts, are partially aimed at the control of the railroads. With the struggles for stock control of railroads and other matters concerning ownership, rates, etc., this present paper has nothing to do. There is, of course, a danger of too much legislation in many lines, and railroads are a shining mark for the aiming of repressive measures. Sanitary legislation has *not* been overdone, and the regulations of many states are defective in this regard. There are many city regulations regarding railroads, and the Southern states find it necessary to keep a constant supervision over the railroad stations and yards on account of perishable or offensive merchandise in the cars and on account of the close contact with Cuban and other southern ports.

Trolley cars are regulated by a host of laws, most of which are not of interest to the physician. Spitting upon the floors, the raising of clouds of

dust by the rapid passage of the cars, the heating and ventilation of the cars, the noise caused by flat wheels, the cleaning of the cars, the safety from electric contact in cars and wiring, the enclosing of platforms and car ends, and other features are largely matters of city regulation unnecessary to discuss, as the remedies are so apparent. Most any code of city laws will afford models for the preparation of ordinances in places where none exist.

Shipping.—The laws are very explicit as regards the quarantine of vessels, either infected themselves or coming from infected ports. (See the chapter upon "Quarantine.") The quarantine regulations of the South Atlantic and Gulf Coast States provide a numerous group of prohibitions and regulations incident to the direct work of quarantine, but, at the same time, leading to general sanitation of the vessel, cargo, passengers, and crew.

Regulations specifically applying to vessels are not so very commonly enacted, the rules of the harbor master or of the local board of health applying in general. Regular lines of steamers or sailing vessels are regulated by various laws requiring boiler inspection, the provision of life-saving devices, and other matters depending somewhat upon the nature of the business in which the vessel is engaged. The following is of interest in this connection:

HARBOR OF MANILA, RIVERS, ESTEROS, CANALS, AND OTHER WATERWAYS AND VESSELS THEREIN

SEC. 179. *Unlawful use of esteros.*—No estero shall be used for the purpose of storing, keeping, or retaining, for a period greater than forty-eight hours, logs, timber bamboo, or other objects which may obstruct the flow of water therein, and thereby render the estero a menace to the public health.

SEC. 180. *Sanitary maintenance of vessels and boats.*—The owners, agents, lessees, or occupants of vessels, launches, lighters, cascoes, barges, bancas, or any other form of water craft shall cause them to be maintained in a cleanly and sanitary condition at all times.

SEC. 181. *Sanitary accommodations.*—Owners, agents, or lessees of vessels, launches, lighters, cascoes, or barges shall cause to be constructed on such craft water closets or other form of latrines, in accordance with plans and specifications approved by the director of health.

Any of the aforementioned vessels having water closets or latrines at the time of the passage of this code may be required to reconstruct them in accordance with approved sanitary ideas, if, in the opinion of the director of health or his accredited representative, such change is necessary.

SEC. 182. *Filth and garbage.*—No filth, offal, garbage, solid matter from manufacturing, stable manure, sweepings, dead animals, or animal or decayed vegetable matter shall be discharged, thrown, placed, or allowed to fall or escape, nor shall any person urinate or defecate into any river, estero, canal, or along the banks thereof.

SEC. 183. *Nuisances and indecent exposure.*—No passenger, employee, or other person aboard any vessel, launch, lighter, casco, barge, or other form of water craft, shall be allowed to commit any nuisance or indecently expose the person in a public manner.

SEC. 184. *Water from rivers, esteros, or canals.*—No person shall be allowed to use the water from any river, estero, or canal for cooking or drinking purposes or for washing or cleansing articles of food or cooking utensils unless the same has been boiled or otherwise made sterile.

RAILROADS

An as introduction to the subject of railroad sanitation, it will be found profitable to consider first some general conclusions by a specialist upon the subject. Dr. Thomas R. Crowder, superintendent of sanitation of the Pullman Company, read a paper at Mexico City that so well presents the subject, in many of its phases, that I asked the doctor for the privilege of reproducing parts of it. As he kindly gave his consent, extracts from the paper here appear. It can be found in its entirety in *The Journal of the American Medical Association*, May 11, 1907:

THE PROBLEMS OF CAR SANITATION*

The railway had long ago reached such a stage of activity in America that its sanitary problems became of importance. It was not until very recent years, however, that these problems were adequately or at all generally discussed. The rapid development of the means of travel gave us a new set of sanitary questions. These have been in part answered in the papers by Bracken,¹ Hurty,² Conn,³ Dudley,⁴ Trask,⁵ Rose-nau,⁶ and others. That the problems presented have not yet been solved in all their relations, however, is amply proven by the great diversity of opinion still held by sanitary experts. Further investigation is needed. It is desirable to know many facts difficult of determination. But in the working out of new sanitary problems frequent orientation is necessary in order to keep them in their right relations, to apply the general principles of sanitary science, and to prevent confusion of the major and minor questions at issue. I wish to make a brief inquiry into the dangers which railway travel may hold out to the public health, and to measure the influence of car hygiene in averting these dangers.

This inquiry may be directed under three general headings: First, the danger arising from the mechanical accidents; second, the danger of contracting infectious diseases; third, the danger incident to a group of miscellaneous influences, such as the rapid and variable motion, faulty ventilation, heating and lighting of cars, and the breathing of dust, smoke, and engine gases.

* By Thomas R. Crowder, M.D., Chicago. Read at the annual meeting of the American Public Health Association, Mexico City, December, 1906.

1. (a) Sanitation and Its Bearing on Certain Railway Problems. *The Railway Surgeon*, September, 1903. (b) Infection in Transportation, *Am. Med.*, Aug. 12, 1905. (c) A Few Points Relating to Car Sanitation, *Rep. of Am. Pub. Health Assn.*, 1905, xxxi.

2. (a) Passenger Coach Sanitation, *The Railway Surgeon*, Oct. 16, 1900. (b) *Railway Sanitation*, *Ohio San. Bull.*, 1906. (c) *Internat. Jour. Surg.*, May, 1902, p. 155.

3. (a) Report of Com. on Car Sanitation, *Reports of Am. Pub. Health Assn.*, 1903, xxix. (b) *Internat. Jour. of Surg.*, May, 1902, p. 152.

4. (a) The Dissemination of Tuberculosis as Affected by Railway Travel, *Med. News*, Dec. 16, 1905. (b) *Passenger Car Ventilation System*, Altoona, 1904, (Pa. R.R. Co.)

5. The dangers of Unrestricted Traveling of Consumptives, *Jour. of Assn., of Mil. Surg.*, 1905.

6. *Internat. Jour. of Surg.*, May, 1902, p. 157.



LATEST TYPE SLEEPER

Northern Pacific Railway Company

Note the change in arrangement of windows. This car can be disinfected with formaldehyde, but is not so well adapted as is the sanitary day coach. Wood carving is avoided, so that disinfecting solutions can be the more readily used.

Indirect radiator hung close to basement ceiling. Air duct leading in from outside pure air.

DANGER FROM MECHANICAL ACCIDENTS

First.—Though the first of these items—the danger from mechanical accidents—is, in its ultimate analysis, the most important, and in the broadest sense a sanitary problem, we may, for the present purpose, leave it out of consideration. In the nature of things, the professional sanitarian has little to do with the measures taken to prevent such accidents. They are the special concern of the railway management, and require neither the knowledge nor the training of the physician to properly interpret and understand. The economic consideration which they involve may be trusted almost alone to work out their remedy.

DANGER FROM INFECTIOUS DISEASE

Second.—The liability of a passenger to acquire an infectious disease during his period of travel, while a more intangible danger, is one, the protection from which is the sanitarian's special interest; and its correct interpretation requires all his technical training and his knowledge of technical facts. It covers most of the important problems of our sanitation, strictly interpreted.

We may profitably divide our consideration of this phase of the subject also into three parts: 1, the danger of infection through association, that is, by direct contagion; 2, the danger from the use in common of the facilities for comfort and convenience; 3, the danger from the infected car.

1. The association of any considerable number of persons in any confined space renders each one a possible victim of the contraction of a contagious disease. This holds true in the railway coach in the same degree that it holds true for other public places. It is increased by the railways only to the extent that they facilitate intermingling. That the average danger is in general slight, and is not worthy of exerting any deterrent influence on social intercourse or travel seems to be a generally accepted opinion. It is nevertheless probable that such association is responsible for a very large proportion of the ordinary acute infections, and particularly of those affecting the air passages.

It is, of course, desirable that every effort should be made to limit as far as possible the association of the diseased with the healthy in public places. The only obvious way to accomplish this is to deny to the sick the right of mingling with the well. In case of smallpox, scarlet fever, measles, diphtheria, and a few other manifestly contagious diseases we do this, depriving the affected individual of his liberty if necessary to insure his isolation. But a host of other infections, which may under certain circumstances become directly communicable, are allowed to associate at will. Consider, for instance, influenza, a disease usually prevailing in epidemic form, spreading with such remarkable rapidity as to leave no doubt of its extreme contagiousness. Produced by a bacillus known to have very little resistance to desiccation, sunlight, and unfavorable temperatures,⁷ to exist in large numbers in the sputum and nasal secretions of the infected, the disease is transmitted directly from man to man, and chiefly, it is supposed, by means of infected droplets expelled in coughing and sneezing. Those afflicted with influenza are very often still well enough to go about their business and their travels, and thus be spreaders of the infection. Again, it has long been recognized that mild and atypical cases of various contagious diseases are by no means rare. That scarlet fever may have no eruption, mild sore throat be really diphtheritic, that even smallpox may be mild and unrecognized, are facts which have been well established during the last decade. Indeed, we know that there is a vast number of people with unrecognized contagious disease who go about in apparent health spreading their

7. Rickets: *Infection and Immunity*, Chicago, 1906, p. 395.

infection. Furthermore, it is well known that virulent organisms may continue to be produced in the bodies of those infected for weeks or months after recovery from the disease, and that pathogenic organisms are frequently found even in those who have never been sick at all. . . .

This leads me naturally to speak of the often repeated proposal that special cars should be furnished for the diseased, more especially for the tuberculous. The proposal undoubtedly has great virtue, and I would say that it should be acted on forthwith if there were not what seem to me insurmountable obstacles to carrying it into effect. In the first place, there is the economic consideration. The amount of such travel will not justify furnishing special cars. These people are often, indeed usually, too poor to pay for the extra expense entailed. Railways are economic institutions, and cannot be expected to furnish transportation at a loss. The state is not yet sufficiently impressed with the desirability of isolation to be willing to pay the deficit. But of even greater practical importance is the great probability that it would be impossible to get more than a small proportion of tuberculous patients into such special cars. It is not necessarily the bedridden consumptive who affords the greater danger of infecting his associates. Far more important is the patient, either unsuspecting or showing no conclusive signs of the disease to the casual observer, who would still insist on traveling as a healthy individual travels. *Of this class of patients there are vastly more going about the world than of those severely sick.* Only a law making it a misdemeanor for him not to declare his disease when applying for railway transportation would force him into his proper compartment; and even then, perhaps, a large proportion of them would either avoid or defy the law and take their places in the ordinary coach and sleeping car and escape detection. In its last analysis the question would remain not so much one of the car as of the habits of those who use the car.

By adopting a pessimistic view we may theorize the dangers of free social intercourse into formidable proportions. The most constant optimism cannot argue it into an entirely negligible quantity. I have already expressed the opinion that direct contagion is responsible for most of the contagious diseases; but we must confess that it is a subject which it is difficult to materially alter in any other way than by education in personal hygiene which both the sick and the well should apply, or by changing public sentiment on the subject of allowing those sick of certain diseases the freedom of intercourse and travel.

THE CHANCES OF INDIRECT INFECTION

2. What are the possibilities of indirect transmission by reason of the use in common of a car's facilities for comfort and convenience? The answer to this question goes back, in great measure, to the determination of how many travelers are afflicted with transmissible diseases or harbor pathogenic organisms — a subject which has been touched on in the consideration of direct contagion. Statistics are not at hand, and are scarcely possible of compilation, showing the proportion of the infected to the healthy among railway travelers. . . .

The railway should provide facilities in keeping with the state of sanitary science and the hygienic habits of the people; it cannot, however, at all times enforce their proper use; and at any stage of perfection in the facilities provided abuses are liable to occur which must be laid at the door of the public. The providing of sanitary appliances is the railroad's duty; the maintenance of sanitary conditions is largely dependent on the users. Consider the washbasin. It is much maligned, and, to a degree, justly so. It is often left abominably dirty by the user; it is much used as a receptacle for washing the teeth; it is frequently used as a cuspidor. With smooth basins and plenty of water this will entail no very great danger, perhaps —



A PULLMAN, A DAY COACH, AND A DINING CAR

This group shows the benefit of a good example, the day coach and the dining car being modeled after the Pullman. All are twelve wheelers, truss braced, and are supplied with special ventilating systems, as shown upon the tops of the cars.

we regularly use contaminated water for bathing purposes and consider it safe — but it is, at least, a disgusting and a dirty habit. It does not arise from the conditions existing in the railway coach; it is brought there by habits formed at home, and it should be corrected at home. . . .

The dangers of indirect infection in railway coaches increase theoretically, and no doubt practically as well, in proportion to the length of time a car is in service on any single trip. The longer the trip the longer the personal association of passengers, the greater their necessity of using toilet and other facilities at hand, and consequently the greater the liability of pollution. Other things being equal, the sleeping car would, therefore, be more liable to contamination than the day coach. Its average journey is longer. Other things are not equal, however, because of the constant supervision of the sleeping car en route, more care at its cleaning terminal, its average higher class of patrons, and its carrying fewer persons to the car.

It is largely in the power of railway passengers to annul on the one hand the dangers incident to their own intermingling and, on the other, whatever measures the railroad may take for their protection. They have the right to demand, nevertheless, that the railroad provide facilities whereby they may carry out to the utmost their own protection. Closets should be well flushed, perfectly emptying, and capable of easy cleaning. Lavatories should be supplied with abundance of water, well drained, trapped to prevent back flow of water and entrance of dust; the surface should be smooth and easily cleansed by rinsing and wiping. If each user would rinse and wipe out a wash basin after using it he would do no more than his hygienic duty, and reduce to the vanishing point its liability of conveying infection. Small towels should be supplied in such abundance that each needs to be used but once. While the common hand towel is perhaps practically without danger, one should never be obliged to use the common face towel on account of the danger of trachoma and other eye diseases.

The common drinking cup has been much discussed and rigidly criticised of late, and orders for abolishing its use entirely have been considered by the surgeon general of the United States Public Health and Marine Hospital Service. It would be a sweeping reform, and the effect of such a move on the public humor cannot be read in advance. For the present the railroad is obliged to furnish something in the way of a drinking cup, however, and the attempt should be to provide one with the least liability of conveying infection from lip to lip. It should have a perfectly smooth surface, outside and in, preferably made of glass to better accomplish this result and to render immediately visible gross contamination and dirtiness. It is through the medium of the common drinking cup that the closest indirect relations, from a hygienic viewpoint, are established between passengers; and it is here, perhaps, that the greatest danger of the indirect transmission of disease arises. There is considerable experimental evidence of cup contamination. A. Moeller,⁸ of Berlin, has recently found tubercle bacilli, influenza bacilli, staphylococci, and streptococci on the edges and in the residue remaining in communion cups. Kinyoun⁹ found pneumococcus, streptococcus, staphylococcus aureus, and diphtheria bacillus once each in twenty-one drinking cups from sleeping cars. Probably cups in constant or oft-repeated use are very generally infected, since mouths are always so, and people generally are careless drinkers. For the most part they contain harmless bacteria (Kinyoun found but one of the organisms isolated to be really pathogenic, the diphtheria bacillus, while the pneumococcus was very slightly so); and the same number of organisms found in the wash basin would no doubt be entirely harmless; but the drinking glass comes a little too close for comfortable suspicion. Its contents gain direct entrance to the body

8. Deutsche med. Wochschr., 1905, xiv.

9. The Bacterial Content of the Railway Coach, Med. News, July 29, 1905.

and traverse the whole gastrointestinal tract with its vast extent of absorbing surface where some point of entrance for organisms may be found. Obviously the danger of transmission from this source is greatest in those diseases where there are lesions in the mouth, as syphilis, actinomycosis, aphtha, and tonsillitis; and quite as obviously the simplest way to avoid it is for each person to carry his own drinking cup, as many do already. . . .

The drinking water should be the purest locally obtainable; it should be cooled by ice from sources of a pure supply, which should be well washed before putting into the tanks, and handled only from clean receptacles with tongs or clean gloved hands. The water cooler should be removable and cleansable and protected from possible contamination by car occupants. They should be frequently scoured and steamed. These are clear-cut duties of the railroad or car company, and distinctly apart from the hygienic duties of the traveling public.

3. Hangings, linen, and bedding are, in general, appurtenances of sleeping cars only. What part are they likely to play in the indirect transmission of disease? Linen may be at once dismissed from consideration, since it is always fresh to the user. So far as any single trip is concerned, the hangings and beds belong in lots to single individuals, and the consideration of their possible danger to the health of the traveler brings us to the discussion of the third element of the danger of infection in railway travel, namely, the possibility of the car itself being infected in such a way as to transmit disease to its occupants. This is dealing simply with a new phase of the question of indirect transmission of disease — indirect transmission from previous passengers or from extraneous sources.

Some investigation of this problem has been made in both this country and in Europe. The investigations of Kinyoun, above referred to, included: 1, The bacterial content of the dust from carpets; 2, the bacteria obtained from the interior furnishing of the coach; 3, the bacterial content of the air of the coach, and, 4, the bacteria of the drinking cup, already referred to.

It is worth while to review the results of these examinations. Dust was obtained from two hundred cubic feet of air passing over carpets being swept, beaten, or blown with compressed air. In seven samples so obtained many varieties of bacteria were found, principally those ordinarily found in the air. Microscopic search failed to demonstrate the tubercle bacillus among them, and animal inoculations proved its absence. The pneumococcus, staphylococcus aureus, streptococcus, and colon bacillus were the only pathogens found; of these the author says, "Only the pneumococcus proved pathogenic, and this but slightly so." Some of the inoculated animals, I find from the subsequent text, however, developed abscesses from staphylococcus infections, a result to be expected, no matter what the source of the dust.

Dust was collected from the interior furnishings of twenty-nine sleeping cars, three day coaches, and two smoking cars by rubbing sterile moist swabs over not less than fifteen square feet of surface. Eleven of these cars were running to health resorts during the height of the travel. Microscopic examination of these samples showed them to contain various bacteria and the ordinary elements of the dust of inhabitations. Of numerous samples stained for the tubercle bacillus two gave positive tinctorial and morphologic results. Sixty-four animal inoculations gave one positive tuberculosis, five pneumococcus infections, one diphtheria, two staphylococcus, two streptococcus, two colon bacillus, one malignant edema, one streptothrix, and six hemorrhagic septicemia. Forty-three animals gave negative results.

Realizing that the pathogenic bacteria floating in the air are of greater relative importance than those with stationary lodgment, special attention was given to their examination. Amounts of air ranging from 1,500 to 7,200 cubic feet were aspirated

from forty-eight occupied coaches, twenty-seven running to and from health resorts, and its dust filtered out and subjected to analysis. The author says: "The majority of the bacteria found in the air evidently had their origin, as would naturally be expected, from the outside air." Ninety-six animal inoculations were made which resulted as follows: Tuberculosis one, pneumococcus infection eight, staphylococcus infection four, general septicemia five, malignant edema one, negative seventy-six. The pneumococcal infections were obtained from the air of smoking cars almost entirely. . . .

Though we must expect most cars to contain pathogenic micro-organisms in greater or lesser numbers, it is nevertheless desirable that the railroads should take precautions to reduce them to a minimum. Good mechanical cleaning is of first importance. Remove dust, and dirt or excreta that may become dust, and most of the bacteria, grossly considered, will be removed with it. Beat or blow with an air blast the seats and carpets, outside the car if possible. It will not remove the last particle of dust, but if it is well done not enough will be raised from them in ordinary use to afford danger of infection to the car occupants. Scrub the floors, wash basins, and closets and disinfect them regularly. Wipe down the woodwork. Expose bedding to the disinfecting influences of air and sunlight and to beating and blowing. If the sick have occupied coaches or sleeping cars fumigate them at the end of the run. In addition, regular fumigation at stated intervals is indicated simply as a prophylactic measure. There has been applied to the Pullman service within the past year a system embracing all these measures, and one which in my judgment meets the more important requirements for the maintenance of sanitary cars. Much labor is expended in removing dust, much time is given to sunning and airing; smoking rooms and closets, basins and cuspidors are washed daily with disinfectants; cars that have carried the sick are fumigated; all cars are fumigated monthly, and those running to health resorts weekly or oftener. The public has a supplementary duty, and the members of the medical profession a complementary one; educate the social body to an appreciation of its own power of self preservation.

THE MORE INDIRECT DANGERS

Third.—The miscellaneous influences constituting the third group of the dangers of railway travel, as I have outlined them, affect the health of car occupants only indirectly as a rule and tend to reduce resistance rather than to produce disease directly. Certain individuals have peculiar susceptibilities of the nervous system, rendering them liable to the so-called "car-sickness" during any long railroad journey. There are people, too, who almost invariably have attacks of migraine under similar conditions. It is not possible to entirely prevent these results of rapid train motion in the predisposed, though smooth roadbeds and comfortable cars probably tend to lessen the liability of their occurrence.

The ventilation of cars is a vital problem. That it has not been satisfactorily solved long ago is due to its great mechanical difficulties. The car contains, and must contain, a minimum of space for a maximum number of occupants. The swift and changing motion of the train, its constantly changing direction and wind conditions, its rapid transit from cold to warm or warm to cold regions, the necessity of changing the air frequently, the consequent great liability to draughts, and the variable sentiments of the passengers, who must all accept the same amount of air, make up a combination of conditions difficult to manage. The real difficulty arises, of course, when the outside temperature is low. Summer ventilation is scarcely a problem. We all know that cars often seem to be ill ventilated and "stuffy," but as a matter of fact we do not know just how good or how poor is the average of car air from the chemical standpoint. . . .

Heating is a problem going hand in hand with ventilation. With the present means at our command it needs but care and intelligent operation to maintain a proper temperature in the closed car. With the attempt to change the air frequently, however, the difficulty is many times increased, for the reason that the entering air is so liable to great variation in amount and temperature as indicated above. If Flugge and his followers are right in their contention that the relation existing between temperature and moisture and the motion of the air are responsible for the whole of the bad effects of ill ventilation, then the problem of heating becomes relatively more important than it has heretofore been considered and ventilation relatively less important.

A certain amount of dust and smoke and locomotive gases inevitably enter the train. These are, of course, liable to great variation; but smoke and gases are not really troublesome except in passing tunnels, when they produce no more than temporary discomfort. Ordinarily only the heavier particles of smoke — the small cinders — enter the car, the lighter solid particles and the gases floating upward and away with the wind. If we are forced to breathe much smoke for prolonged periods it acts as a mechanical irritant and exerts a harmful influence upon the respiratory passages. Ascher* of Königsberg published a series of experiments on animals showing that it both hastens the fatality of tuberculosis and predisposes to acute infections of the lungs; and he arrives at similar conclusions concerning human beings from a study of the vital statistics in relation to smoke production in the manufacturing towns of Prussia.

Ordinary dust is of more importance because it is more prevalent and because it may be infectious. It comes chiefly from the railway tracks, and their nearly universal free exposure to the sunlight makes it very probable that any pathogens will be rendered innocuous before the dust stage of their container is reached. Track contamination is probably of greater danger to the consumers of the water of streams into which sewage may be washed before it has a chance to dry than to the users of cars. The mechanical irritation of dust is, however, of some importance. It may produce mild inflammation directly, or it may lower the resistance of the mucous membranes of the respiratory passages to the point of favoring infections. Certain dusts, as those of the alkali deserts, which are soluble in the secretions, may act as chemical irritants. Sprinkling of the track with oil, as is practiced by some railroads, is, therefore, a salutary measure from a hygienic standpoint. To convert dust into something else than dust removes the difficulty in the best way, and is in the end the simplest. Of next efficiency would be some air-filtering device.

It need scarcely be said, in conclusion, that it has been the author's purpose rather to define and to estimate the importance of the various problems of car sanitation than to detail their solution. That there is always a slight danger of acquiring infectious diseases in railway coaches cannot be denied. That this danger is chiefly dependent on direct contagion in the close personal association of passengers seems probable, while indirect transmission through the common use of facilities for comfort or by the infected car is of secondary importance only.

An attempt has been made to show why it is that personal hygiene is a most important element in the solution of the problems of car sanitation and why the co-operation of travelers is necessary to an effective combat against the contraction of infectious diseases in cars. This statement must not be interpreted as a defense of the railway company which does not take every reasonable precaution to maintain its cars in a sanitary condition, or does not provide facilities whereby the liability of the transmission of infectious diseases may be reduced to a minimum. The duties of the railway in this regard are perfectly clear, and their fulfillment is essential to the maintenance

*Der Einfluss des Rauches auf die Atmungsorgane, Stuttgart, 1905.



DINER KITCHEN. SMALL

MODEL LAVATORY
Northern Pacific Railway Company

of the public health. Bad habits in matters of personal hygiene are due largely to ignorance. It is the correction of this very general ignorance in the public at large that must supplement the best car sanitation in order to bring it to a high degree of efficiency in protecting those who travel.

It will be observed that Dr. Crowder, who has had unusual opportunities to observe, is not an alarmist, and does not sympathize with some of the views recently expressed as to the extreme dangers from which passengers in sleeping cars may or may not escape. As the doctor specifically permitted the use of this paper, the inference is that it represents his views to-day. Certainly he has raised some important questions as to the duties of the passengers themselves. Since the paper was written, the Pullman Company has added to their cars a dental lavatory, but it has not been very freely used by the public. A trainman tells me that they are supplying a special steam inlet to heat the smoking apartment to a greater degree than the rest of the car. This renders the car more comfortable to the officers of the car and to passengers who sit up a part or the whole of the night.

In order to present both sides of the matter and give a word to the gentlemen who feel that the companies operating sleeping cars do not do enough in the way of sanitation, I will quote from an article by John R. Haynes, M.D., Los Angeles, that I clip from the Michigan "Public Health":

Undoubtedly many people contract tuberculosis while traveling on railroads and, more especially, while traveling in sleeping cars.

I have crossed this continent at least twenty times and do not remember an occasion when there has not been some one with tuberculosis in the car in which I lived, and, generally, a number on the same train, and on several occasions death from tuberculosis has occurred. You will pardon me for mentioning an instance or two which will forcibly bring to your minds the danger of permitting tuberculous passengers to travel freely with others.

A year ago when I was crossing the continent a passenger who bore all the earmarks of advanced pulmonary tuberculosis — hollow cough, expectoration, emaciation, shallow, rapid respiration, and hectic flush — entered the Pullman sleeper. In the morning he was the last one to arise, and when the curtains of his berth were removed I saw that the window at the head of his berth was so covered with sputum that the glass was translucent instead of transparent. What possessed the man to expectorate against the window I do not know. He left the car soon after arising, and the porter cleaned the window in the perfunctory manner common to men filling his position. On returning to my seat after a couple of hours' stay in the smoker I found that a woman and little girl had been assigned the berth just vacated by our tuberculous passenger, and the little girl was standing on the seat looking out of the window with her face pressed against the pane, and, as is the common custom among children, touching it with her tongue and lips. . . .

SUGGESTIONS FOR REMEDYING THESE CONDITIONS

I would suggest that added to the questions now asked by the ticket agent of those about to make long distance journeys, should be the following: Do you cough? If the reply is in the affirmative, then the would-be passenger must bring a certificate from the health department — if there is no health department, then from the railroad physician, and, lacking the latter, then from any reputable physician — stating the cause of cough.

If the case is one in which, in the opinion of the health officer, death within a few months or a year is inevitable, then a ticket should be refused the applicant unless he is being sent to a sanatorium to end his days, or is away from home and desires return. . . .

Special cars.— Should, however, the health officer hold that recovery is possible in the climate in which the passenger proposes to seek relief, then he could be informed that he can go on a certain day, on a certain train, and in a certain car.

This should be a compartment car with compartments opening on a corridor running along one side of the car and not in the center. Each compartment should have two berths placed lengthwise with the car, a water closet not enclosed, and a folding washstand with running water. (This is the regular compartment car used on a number of our railroads.) The floor should be covered with linoleum, or better, should be of cement and a small rug used. The upholstery should be of leather or, preferably, of movable cushions with washable covers. The hangings, if any, should be of washable material and the woodwork as plain as possible. All dejecta should be thoroughly disinfected before being allowed to escape from the closet. The sputum cups should be of pasteboard and should be burned in a stove designed especially for that purpose. There should be such a stove in each car.

Each hospital car should have a trained nurse in attendance whose business would be to care for all who needed her attention.

The hospital car should be attached only to trains having dining cars, and all meals should be served à la carte at reasonable rates to the passengers in their compartments and all dishes should be thoroughly disinfected and the paper napkins burned.

The cars should be run as often as necessary, once a week or once in two weeks, and should be large or small, as the railway companies should decide from experience.

Disinfection.— When a compartment is vacated by a tuberculous passenger, it should not be used again until thoroughly disinfected with formaldehyde, everything washable boiled, the woodwork and floor thoroughly cleansed, and the movable cushions, mattresses, and blankets disinfected in a hot room. . . .

Short journeys.— For those traveling a short distance covering only a few hours, a portion of a car should be set apart, a portion like the smoking compartments of a baggage car, for instance, without upholstery. It should be a chair car with one row of chairs only along each side of the car and near each chair a small, movable compartment into which a pasteboard sputum cup could be placed, and which could be lifted from its bracket and disinfected and the sputum burned at designated places.

These cars, like the hospital sleeping cars, could be run once a week, or a small portion of one car holding from four to six chairs could be run once daily.

OBJECTIONS

The railroad company may object to carrying out the ideas suggested on account of the fact that they would be losing interest on the cost of cars not in constant use, and on account of the expense of an attendant or nurse and the extra expense of disinfecting by heat. But when we consider the enormous amount of money spent in palaces on wheels by the railroads, we believe that any objections on the grounds of expense would not be well founded, for they owe protection to society.

With reference to passengers of limited means traveling a long distance the health authorities should bear a part of their expenses, as they would if transporting those sick from other contagious diseases, such as leprosy or smallpox.

The objection is raised that people would decline to travel in the manner suggested, being branded, as it were, as diseased creatures to be avoided. Sentiment must be

brushed away and tuberculous passengers must travel in such a manner as society may prescribe, in order that the many shall be protected. It should be thoroughly understood, by being published in the papers and in railway literature, and, if necessary, by being printed on the tickets, that any tuberculous passenger evading by false representations the provisions for public protection, if discovered *en route* shall be put in the hospital car, if one be attached to the train, or be put off the train at a station where he could be cared for and compelled to wait until the first hospital car going his way arrives; and a heavy fine should be imposed on any physician who would connive at any evasion of these protective regulations.

These suggestions have been submitted to the passenger agents of two large transcontinental lines, and they declare them practicable and feasible, provided the various state health authorities or boards place tuberculosis on the list of contagious diseases. This would give the railroads the legal power to refuse tickets to any one suspected of having tuberculosis or any other contagious diseases, unless authorized by the health officer of the community where the ticket is sold. I think those who control the railroads will soon awake to the necessity of thorough disinfection and isolation and thus add materially to the safety and comfort of their travelers.

It impresses me that proper efficiency lies midway between the views of Dr. Crowder and Dr. Haynes. Nearly all sleeping cars are provided with enough equipment to take care of tuberculous cases. Either requiring them to take an end section next to the smoking apartment or to take a state room will isolate the case effectively. The passenger should be required to pay for the section to the end of the run and no other passenger be admitted to the place vacated until after disinfection. I have taken sick persons in Pullman cars by securing such accommodations, and the matter worked out satisfactorily. To declare tuberculosis a contagious disease *in the same category with diphtheria* would be cruelty, and the public would not support so extreme a measure. Dr. Haynes writes from a section to which the tuberculous resort, and he sees many cases, doubtless, of the aggravated character described; but railroads must meet *average* conditions. Surely a tuberculous case should be required to exercise the same care in a car as he does elsewhere, and the regulations of any railroad are quite sufficient to give any conductor or porter full authority to stop promiscuous spitting, regardless of whether it be tuberculous or not.

Dr. Chas. B. Dudley,* chemist of the Pennsylvania Railroad, has sent me a reprint of an article he prepared, and read before the American Public Health Association, and entitled, "The Dissemination of Tuberculosis as Affected by Railroad Travel." Dr. Dudley is a recognized authority upon railroad sanitation, and his paper is of great weight in the estimation of the actual dangers involved. After outlining the whole range of criticism to which the railroads are submitted in relation to sanitation, Dr. Dudley proceeds to analyze the matter from the standpoint of the men who have undertaken elaborate researches and practical investigations bearing upon the questions involved. These investigations show that tuberculous sputum is not readily dried and pulverized, either in a car or elsewhere. It is loosely stated and commonly believed to be true that sputum quickly becomes dried

*Dr. Dudley has recently died.

and dissipated through the air. Yet Cornet said:

Any one who has himself tried to rub the well-dried sputum into atoms and to pulverize it very finely will agree with me that it is no easy task to produce a really fine powder which remains suspended in the air for some time. The strong statements that have been made up to now that one has only to rub with the foot on the dried sputum to raise immediately a cloud of dust of infectious germs are absolutely false.

Heyman, Hillier, and others are quoted in support of this view, and bacteriologic experiments and the examination of the dust of many cars all tend to show that some gentlemen have expressed alarmist views hardly borne out by either experiment or experience. Sternberg has shown, in the book, "Infection and Immunity," that the "registration areas" of the United States give 187.3 deaths per 100,000 of population, while railroad employees alone have but 129.8 per 100,000. The Pennsylvania Railroad Relief Fund provides protection to over 80,000 members, and very accurate records are kept. Their death rate from tuberculosis, per 100,000 per annum, has been:

All members of the fund.....	90
Passenger conductors.....	77
Passenger brakemen.....	52
Freight conductors.....	100
Freight brakemen.....	67

These figures show the relative lack of tuberculosis among railroad trainmen and especially those in the passenger service.

If passenger cars were such carriers of tubercular infection, surely the trainmen thereon should show figures the reverse of those given. The experience of The Pullman Company is stated to be similar to that of the Pennsylvania Railroad. This latter company employs a bacteriologist, and his investigations have convinced him that the smooth surface will allow the dissemination of tubercular matter much more *readily* than does the ordinarily upholstered car. But, on the other hand, the plush and hangings are more difficult of cleansing than are the smooth surfaces. Provided the hangings and upholstery are frequently cleaned or disinfected, they offer no more danger than does smooth surfaces. Some gentlemen do not favor the use of plush, and it has its dangers, but these bacteriological investigations show that the dangers may be and are very small when the hangings and plush upholstery are regularly cleaned, disinfected, and sunned. When they are *not* so treated, the use of plush and hangings is open to criticism.

But, departing from any possible academic limitation, it will illustrate the actual work of car sanitation better by reproducing the official instructions of a railroad. This instance of correct practice was referred to in discussing the laws of Texas. These regulations are in force upon the lines of the Northern Pacific Railway Company, and were supplied to me by Mr. A. M. Cleland, general passenger agent of the company, and with offices at St. Paul, Minn.

NORTHERN PACIFIC RAILWAY COMPANY

OFFICE OF MECHANICAL SUPERINTENDENT

Permanent Instructions No. 69

DISINFECTION OF COACHES AND SLEEPING CARS

St. Paul, Minn., October 12, 1905

GENERAL MASTER MECHANICS
MASTER MECHANICS
MASTER CAR BUILDER
SHOP SUPERINTENDENT (Como)
CAR FOREMEN (13)
ASSISTANT GENERAL SUPERINTENDENTS
DIVISION SUPERINTENDENTS
SUPERINTENDENT CAR SERVICE
TRAIN MASTERS
CHEMISTS

In future, passenger train cars in service on this company's lines will be systematically disinfected by what is known as the "Potassium Permanganate" method, and in accordance with the following:

1. Three galvanized iron buckets, six pounds potassium permanganate and two gallons forty per cent liquid formaline, will be kept at Glendive, Billings, Livingston, Helena, Butte, Missoula, and Pasco, for emergency use. Six buckets and sufficient potassium permanganate and formaline to disinfect cars tributary to those points will be kept at Minneapolis, Duluth, Spokane, Seattle, Tacoma, and Portland, and a supply of these materials will be kept at St. Paul for filling requisitions.

2. Whenever any car is known to have been occupied by a person afflicted with a contagious disease, such as pulmonary tuberculosis (consumption), diphtheria, scarlet fever, or smallpox, the car will be set out of train and disinfected at first point where such disinfection is practicable, after such car is vacated. In case of tuberculosis, before the regular disinfection with gas, floor, bowls, and cuspidors must be thoroughly washed out with warm water to which has been added one pint of formaline to five gallons.

3. All passenger train equipment must be disinfected from time to time, the frequency of disinfection depending somewhat upon existing conditions. Under normal conditions, cars in transcontinental trains should be disinfected at least as often as every second round trip and those in shorter runs once each month.

During times when any contagious disease is prevalent, the transcontinental cars should be disinfected at the end of each single trip, and those in short runs once every two weeks, or oftener if necessary, and every car must carry record of date of last disinfection in store card box.

ARRANGEMENT OF CARS

1. The fumigation should be done before carpet has been removed or cleaning is begun.

2. Close all outside doors, windows, deck sash, and ventilators tightly, leave one or two windows on each side of car so arranged that they can be opened from the outside, to avoid the necessity of entering the car while fumes are strong.

3. Open all interior doors.

4. Pull seats forward and loosen pillows in pillow boxes.

5. Open upper berths and lay head boards across the seats so that one corner rests upon a seat arm.

6. Lay lower mattress on the headboard with middle arched upwards by pushing the ends together.

7. Raise curtain poles and hang curtains near the ends by a single hook.

8. Throw blankets over curtain poles, making as few folds or thicknesses as possible.

9. Arch upper mattresses in the berth. It is necessary to make the greatest possible surface exposure of the contents of the car to insure the best results.

DIRECTIONS FOR GENERATING FORMALDEHYDE FROM LIQUID FORMALINE
BY THE USE OF POTASSIUM PERMANGANATE

1. Place one half pound of permanganate in each of these galvanized iron buckets. This should be *done outside the car* in order to avoid dropping crystals on the carpet where they would form spots.

The permanganate will be furnished in one half pound packages, or if in bulk, a measure will be furnished, the measure level full (not heaped) equals one half pound.

2. Place the buckets in the middle of the aisle, one in the center and one at each end of the body of the car.

3. Fill three pint bottles with liquid formaline (beer bottles will do), and pour the contents of one bottle into each bucket. See that no hangings are against or directly over the bucket. Soon after pouring the formaline on the permanganate a violent chemical reaction takes place and the vessel becomes hot, only metal buckets can be used. All three bottles of formaline must be taken into the car at once in order to lose no time.

4. See that the entrance door is closed upon going into the car, and that the exit door is closed upon leaving.

5. Leave the car closed for a minimum of three hours, then open the doors and several side windows. Ten or fifteen minutes after the doors and windows are opened, the car can be entered when all windows should be opened and the car thoroughly aired. The fumes of formaldehyde are not dangerous when breathed in moderate quantity; they are, however, very irritating to the eyes, nose, and throat. It is necessary that cleaning should follow rather than precede fumigation, in order that all odors of formaldehyde may be removed before the car is put into service.

DAVID VAN ALSTYNE, *Mechanical Superintendent*
W. GILBERT, *General Superintendent*

NORTHERN PACIFIC RAILWAY COMPANY

OFFICE OF MECHANICAL SUPERINTENDENT

Permanent Instructions No. 41-C

(Superseding P. I. No. 41-B and Supplement "A" to P. I. 41)

DISINFECTION AND CLEANING OF PASSENGER CARS

St. Paul, Minn., February 15, 1906

GENERAL MASTER MECHANICS

MASTER MECHANICS

MASTER CAR BUILDER

SHOP SUPERINTENDENTS

ASSISTANT SHOP SUPERINTENDENTS

CAR FOREMEN

GENERAL CAR FOREMEN

FREIGHT CAR SHOP FOREMEN

COACH SHOP FOREMEN



OBSERVATION CAR

ELECTRIC PLANT, BAGGAGE CAR
Northern Pacific Railway Company

1. The outside of all cars, except those in transcontinental service, shall be wiped off with dry waste, except when cleaning with water is necessary on account of rain or damp weather. Windows to be cleaned with DeLaney's or other approved car cleaner and wiped dry with old linen or white waste.

2. Cars in transcontinental service shall be washed with water at the end of each trip, and cars of the "North Coast Limited" trains shall be further rubbed off with dry waste on the morning of departure from terminals. Cars are to be scrubbed every six months with DeLaney's car cleaner or other approved cleaner, and the date of such cleaning shall be marked on needle beam. Monthly report of cars scrubbed to be sent to shop superintendent at Como.

3. Whenever available, compressed air shall be used for cleaning window boxes, including deck sash openings, and all corners where dust may lodge. Also seats, seat backs, curtains, carpets, lamp burners, and lamp jacks. Cushions, curtains, and carpets will be removed from car for cleaning. Cushions in cars of transcontinental trains to be air cleaned at the end of each round trip; those of all other cars about every four thousand-mile run.

4. Platform floors and heater pipes to be scrubbed with warm water and soap after car has been swept or blown out with air. One pint of "Kreso" to six gallons of water to be used for car floor, one pint of formalin to six gallons of water to be used in scrubbing floors of closets and smoking rooms. In scrubbing, use water sparingly; floor of car must never be flooded.

5. Trucks to be cleaned by first brushing off with an old broom and then washing with a half and half mixture of kerosene and water, applied with a car wash brush, and then brushed off with a dry brush.

6. Head linings and interior finish shall be cleaned every three months, or oftener when found necessary, with Murphy's Oil Soap, one pound of soap to be dissolved in one gallon of water by inserting a jet of steam or placing over fire, soft or distilled water to be used when practicable. Parts to be scrubbed with a sponge, rinsed, and wiped dry with chamois skin, and rubbed down with renovating oil and white waste.

Inside woodwork of cars in transcontinental trains to be wiped with dry white waste at the end of each trip.

7. Platforms that are not covered with rubber, and floors of coaches when aisle strips are not used, to be painted with floor composition every six months or oftener if necessary. Iron hand rails to be painted with quick-drying black paint once in three months.

Steam and hot water pipes to be bronzed or painted when necessary, generally when floors are painted.

8. All brass work to be cleaned with oxalic acid and whiting in water, and polished with Putz Pomade or other approved metal polish.

9. Closet hoppers and urinals in all cases shall be cleaned at the end of each trip with warm water, to which has been added one half pint of formalin to a pail of water, and once a week they shall be cleaned with one third muriatic acid and two thirds warm water.

10. All water coolers shall be washed out every trip and when necessary shall be scoured and steam cleaned.

11. Directions for using DeLaney's car cleaner:

(a) To one barrel of water add thirty-two pounds of DeLaney's cleaner, stir thoroughly, and let stand for twenty-four hours. It is then ready, but should be stirred before using by means of a clean wooden stick. Carry in clean wooden pails.

(b) Use a stiff bristle car wash brush with a long handle, and clean ten feet of surface at one time, then rinse with clean water, in winter use warm water. Glass in sash and doors to be cleaned in the same manner when cleaning car body.

(c) DeLaney's car cleaner has no injurious effect upon the varnish, but improper rinsing leaves the surface white, and care should be taken to have every particle of the cleaner removed.

12. Directions for use of "Zenoleum" or "Ozonot" disinfectants:

(a) For cleaning chairs, settees, etc., add one fourth of a pint of disinfectant to two gallons of water and use as a wash.

(b) For scrubbing floors, etc., add one half of a pint disinfectant to two gallons of water, apply and dry with mop.

(c) For disinfecting lavatories, closets, refrigerators, etc., add one half of a pint of disinfectant to two gallons of water and use freely.

(d) For interiors of refrigerator cars this quantity may be increased as conditions demand. Use freely and sweep out with brooms.

D. VAN ALSTYNE, *Mechanical Superintendent*

After April 14, 1906, the chemist of the company put into use "N. P. Cleaner" and "N. P. Metal Polish" in place of "DeLaney's Cleaner" and "Putz Pomade."

The Northern Pacific Railway Company operates six thousand two hundred and eighty-five miles of railroad line in several states, and runs trans-continental trains. In January, 1907, the stockholders authorized an increase in stock of from \$155,000,000 to \$250,000,000, the increase to be used for improvements. This has equipped the company with unusually fine rolling stock, and done other things not of so great hygienic interest. Some of the cars of this company are here illustrated, with comments thereon. From the standpoint of the sanitarian, there are many very badly constructed passenger cars in use in the United States. For short runs, these bad cars do not become seriously infected, but when a train is run for thousands of miles a poorly constructed car is a positive menace to health. There are many railroads in this country running splendid trains, and that are awake to the necessity of car sanitation. Unfortunately, some of them fumigate only when especially demanded. The Northern Pacific attends to such matters as regularly as it paints its cars and sets a splendid example to other roads. Had I taken the time to write to more railroads than I did, doubtless other lines would have sent me equally good regulations, but, as some companies failed to answer my letters, the assumption is they are doing very little sanitary work to tell about. In general, replies to my letters revealed a sincere desire to keep up with the times and the legislation upon the subject and the railroads are, one after another, beginning to organize a work in sanitation. Space precludes entering into the matter in detail, but my inquiries have revealed no other road that so systematically *follows up* disinfection in the manner indicated by the Northern Pacific orders just outlined.

The Pullman Company is earnestly striving to do the right thing, but its limitations consist in the facts that their cars are run over all kinds of roads, and in many states without any legislation upon car sanitation. In these latter states, terminals often fail to provide for car cleaning and disinfection

up to the Pullman standard. I have no doubt at all that the Pullman Company would be delighted if all of the states passed a reasonable law requiring proper facilities at all terminals. At present, they are in the position of the man who has a fine automobile, but must run it over some very poor roads.

Before leaving this subject, I wish to quote from a paper contributed to the "Technology Quarterly," by William T. Sedgwick, Ph.D., several years ago.

The disinfectant submitted to me for tests of its germicidal power was said to consist of a concentrated solution of chloride of zinc, chloride of copper, and bichloride of mercury, with a few drops of terebene. The terebene was added as a telltale, to inform the officers whether the disinfectant had been faithfully used, rather than as a disinfectant. I was also informed that the disinfectant contains one part in five hundred of bichloride of mercury and a little over forty-five per cent of chloride of zinc. The chloride of copper was added because a little copper salt was desired to fix sulphuretted hydrogen, and the chloride of zinc solution was made very strong on account of the well-known deodorizing properties of this material.

I am also informed by Dr. Dudley that this disinfectant is made by the railroad company, for its own use, under the supervision of the officers of its laboratory. Old battery zincs which are no longer useful in the batteries, muriatic acid, sulphate of copper, common salt, and bichloride of mercury are used in its manufacture. The actual cost of the disinfecting material in an eight-ounce bottle is about two and one half cents. The material is distributed to the service in wooden boxes, holding twenty-four bottles each, and in barrels. If these boxes and bottles are returned, the real cost to the different parts of the service is the figure given above. If the bottles are broken and the boxes destroyed the cost is somewhat greater. In barrels which are not returned the cost is somewhat less than in bottles, no labor being required for bottling. There were made and used on the whole Pennsylvania railway system during the year 1892, 366 gross of eight-ounce bottles and 69 fifty-gallon barrels.

The specifications to which the disinfectant must conform are given as follows:

Disinfectant for the use of the Pennsylvania Railroad Company will consist of a neutral solution of the normal chlorides of copper and zinc and mercuric chloride put up in eight (8) ounce bottles and securely corked. Each bottle should contain 2,400 grains of zinc chloride, 120 grains of cupric chloride, 10.5 grains of mercuric chloride, and ten drops of a mixture of equal parts of terebene and turpentine.

The bottles must have pasted upon them the following, "Directions for Use," a perusal of which will convey a good idea of the scope and the importance to the community of efficient railway sanitation:

DIRECTIONS FOR USE

For use on cars.—Empty the contents of this bottle into about one quart of water. With a sponge or waste wash with the liquid all parts of the urinal, seat, and hopper, and the floor adjacent to them in the closet, allowing some of the liquid to run down the urinal pipes. The same solution should be used on the floors and woodwork of the whole car whenever washing with disinfectant is necessary. The carpets and plush of an infected car should not be treated with disinfectant, but should be fumigated instead.

For cleaning privies, closets, etc.—Empty the contents of this bottle into about one quart of water, and use as above. The disinfectant acts slowly on lead, tin, copper, brass, iron, etc., and it is not advisable to allow it to stand in the basins or

traps. In the vault, use the disinfectant full strength, not less than half a dozen bottles at once, but it is better to disinfect privy vaults with crushed sulphate of copper, or chloride of lime, sprinkled freely over the mass.

For removing bad odors.—Empty the contents of this bottle into about one quart of water, and sprinkle the liquid in the place from which the odors arise; also saturate a towel, or other fibrous substance, with the liquid and hang it in the place from which it is desired to remove the odors. For use on towels, etc., a disinfectant without color can be furnished if desired.

In cases of diphtheria, scarlet, typhoid, and typhus fevers, cholera, dysentery, consumption, etc.—Place a little of the disinfectant, full strength, in the vessel which receives the excrement or vomit or throat discharge, and pour more of the disinfectant on the discharge after it has been received in the vessel. If the discharge soils the floor or furniture wash these soiled spots with the disinfectant mixed with water as above. Soiled bed and body linen, rags, or handkerchiefs used to receive discharges, and soiled clothing should be burned, or soaked in disinfectant diluted as above, for four hours, and then rinsed with water.

For the dead, where disinfectant is necessary.—Wrap the body in a sheet thoroughly saturated with the disinfectant full strength.

For attendants on the sick.—Empty the contents of this bottle into a pint of water, and wash the hands and other portions of the body, if soiled, with it, rinsing off with clean water. In sickrooms and hospital wards wash all surfaces with the same solution.

NOTE.—This disinfectant when mixed with water as described will not injure the hands, but should not get into the mouth.

CONCLUSIONS

The foregoing experiments appear to establish the fact that the Standard Disinfectant used by the Pennsylvania Railroad Company will, under favorable circumstances, destroy the germs of typhoid fever, diphtheria, Asiatic cholera, and *staphylococcus pyogenes aureus* in a few seconds, and the spores of *bacillus subtilis* and *bacillus anthracis* in a few minutes. It must, therefore, be regarded as satisfactory and of excellent efficiency.

There is no evidence that the zinc chloride materially contributes to its value as a disinfectant, and however great the value of zinc chloride as a deodorant may be, it is probable that if a portion, or all of this, could be replaced by a still more concentrated solution of corrosive sublimate the disinfectant might be improved. The recent paper of Green (*Zeit. für Hygiene*, etc., 13, 511) suggests that the copper chloride also has some value. Finally, the decidedly acid reaction of the disinfectant as received is, from the germicidal point of view, an advantage.

This preparation I believe to be of especial value, and this is based upon some personal use of it, as supplied by a railroad official for purposes of test. Permit me to suggest that any lack of detail in this chapter is supplied, so far as disinfection is involved, in the chapter upon "Disinfection."

Car ventilation is a subject upon which one can find a vast deal of literature. I have profited but slightly in an examination of a portion of it, for the reason that nearly all of the systems proposed are too much subject to the whims of the passengers. Any adequate system of ventilation must be largely automatic and be accomplished without the passenger being aware of how

it is operating. After an examination of the matter to such extent as I was able, it impressed me that the system devised by the Pennsylvania railroad offers so many points of advantage that a description of it will constitute all that I feel is necessary in this brief paper.

It consists in taking air from the outside in through hoods located on what is known as the lower deck near the top of the car, and at diagonally opposite corners of the car. The opening of the hoods is toward the direction in which the car is moving, and, as will be noted a little later, the movement of the car is an element in the problem of getting the air into the car. The opening is covered with a gauze to exclude large cinders. The hood is fitted with a valve operated from the inside of the car in such a way that as the car changes direction the proper passageway is provided. From the hood the air passes through what is technically called a "down-take," about one hundred square inches in area, which conducts the air down underneath the floor of the car to a passageway which occupies the space between the outside sill, the floor, the first intermediate sill and the false bottom. This space has an area of a little over one hundred square inches, and extends the whole length of the car. From this space the air passes up through apertures in the floor into the heater boxes, where it is warmed. From the heater boxes the air passes out into tubes situated under each seat, and is delivered into the aisle of the car from the tubes. From these points it disseminates through the car, and finally passes out of the car through ventilators situated along the center line of the upper deck. These ventilators may be of any approved form. The kind most used thus far has been what is known as the "Globe Ventilator," which ventilator has the characteristic that when the car is moving through the air, or when the wind is blowing across the ventilator, a suction is produced on the air in the car. It will be observed from what has already been stated, that there are two things that cause the ventilating air to move through the car. First, the heating system. The ventilators in the upper deck are situated some two feet higher than the top of the hood, and accordingly, when there is heat in the car, or when the lamps are lighted, there is the proper ventilating movement of air through the car, due to this force. Also it will be noted that the movement of the car is an element in the problem likewise. The car movement produces pressure in the hood and down-take and the ventilators produce suction, as has already been described, and these two acting together lead to change of air in the car. The control of the system, that is the means by which the amount of air passing through the car is diminished, is in the ventilators. Each ventilator is provided with a register, and when these registers are closed the total amount of air passing through the car is diminished a little over one half. It will be observed that by partly closing all the ventilators, or closing a part of them, any intermediate figure between these two can be obtained. It is found essential to have a portion of the passageway in the ventilators over the lamps continuously open, in order to carry off the products of combustion. The register at no time closes this portion of the ventilators over the lamps.

The experimental work having led up to the construction finally decided on, it remained to actually put the system to test and see exactly what was being obtained. The first experiment was to see whether when the car was standing still, and heat was in the car, the movement of the air would be in the desired direction, namely, into the car through the hood, and out through the ventilators on the upper deck. With some systems of car ventilation where the movement of the air is almost wholly a function of the movement of the train, when the train stops the air movement is in the opposite direction, owing to the relation between the heating system and the ventilating system. In the system which we are dealing with this does not take place, for obvious reasons, namely, as has already been stated, the exits are higher than the intakes.

The second test concerned the air from the closet. Some anxiety was felt as to whether the ventilating system would take air from the closet into the car. As a precautionary measure a small "Globe" ventilator was put in the roof of the closet, and also the proportions of parts of the system were designed in such a way that when the car was in service, there would be a plenum in the car produced by the hood rather than a vacuum produced by the suction of the "Globe" ventilators. As a matter of fact, the construction finally adapted gave very close to a balance between these two features. However, many experiments show without question that when the car is in motion, and the ventilating system in full operation, the air movement is toward the closet, instead of from it.

On account of this subject being of vital interest to a small army of railroad physicians, greater details of the Pennsylvania system of car ventilation will be recorded in small type at the end of this section upon railroads.

From my own observation, I believe this system to be superior to that in use by the Pullman Company, but it must be remembered that this latter company runs its cars in territory in which this system might not be adapted. A country full of fine alkali dust is not adapted to a ventilation system taking the air from near the ground. Probably the most difficult cars to ventilate are those being run in the African deserts. They have a most elaborate system to keep out heat and dust.

Let me say a word for the mail clerks. Of all cars I have inspected, the mail car is the worst ventilated. There is a limited number of windows, and the ends of the cars are closed. The lights in these cars often make a great deal of heat, and it is not always adequately vented.

I confess I have not been able to arrive at any satisfactory conclusion as to what should be done with human dejecta in car closets. The Pennsylvania department of health has raised the issue as it contaminates or *may* contaminate the watersheds. So far as I have been able to learn, there is no satisfactory dry closet for train use nor one that even promises ordinarily sanitary efficiency. I have made it my care to ask track men and other railway employees what they think of dejecta upon the tracks. Almost to a man, they tell me that the sun and air promptly disposes of such matter, and that it gives very slight annoyance to track workers. Probably the present system cannot be improved upon, but the closets should be kept locked at depots and when the train is running through cities.

Water and ice supply for railroads needs no especial discussion, as general principles elsewhere discussed apply here. Cars may be quarantined by health boards and occupants may, in some states, be compelled to submit to vaccination when a case of smallpox is discovered in a car.

Section II

RAILROAD FREIGHT

THE total number of persons injured by the railroad freight trains seems to be very large, and yet to carry the same tonnage an equal number of miles would involve vastly more casualties by the older methods of land transportation. Most of our citizens have no adequate idea of the immensity

of the business. Statistics going into so large figures mean very little to us. But let one visit the large classification yards and watch the large trunk lines and note the constant stream of cars, and one begins to feel some sense of the immensity of the great freight business.

Take it all in all, the sanitary faults of this large business are very few. No railroad will receipt for goods in bad condition unless so stating upon the manifest. In consequence, very little freight of an objectionable character is received or shipped. Hides, fertilizers, and live stock are disagreeable but not necessarily insanitary freight. Bones and hide scrapings are probably the worst freight ever carried. I once knew of a car filled with bones being inadvertently sidetracked for two weeks, and it bred maggots to so great an extent that it was necessary to call the fire department to wash the millions of maggots out of the car to an adjacent sewer inlet. The railroad was obliged to use a great quantity of lime to purify the car, the surrounding ground, and the sewer. With the system of car recording and tracers used now, such troubles are almost impossible. Stock is carried in special cars and regularly unloaded and fed, and, on long trips, rested. Stock cars used to be filthy, but such conditions are little tolerated now. The railroads have learned that they are apt to be put to no end of trouble if they accept for shipment diseased cattle.

The foot and mouth disease epidemic of 1908 and 1909 imposed an immense amount of work and considerable expense upon the railroads. Freight cars are much more regularly cleaned than was formerly the case, and this is especially true of refrigerator cars. There are regular icing stations, and whatever we may think of the meat trust and the fruit shippers' trust, they are running sanitary cars, and they have men all along the line or on the trains whose business it is to see that the cars go to destination with as little delay as is possible. The cars themselves are models compared to what they used to be. Crude sugar and many lines of produce, like cabbage, do not smell well in bulk, but it cannot be said that they are insanitary.

Small shipments may become insanitary from the fault of the railroad favoring the shipper who delivers fifty cars, and taking very little interest in the goods of the man shipping but one car and putting the railroad to extra trouble with it. That sort of thing is hard to manage, as railroad men are blessed with just as much human nature as are other people, and are looking out for the profitable business, just like the grocer and the hardware merchant.

Railroad yards are so scientifically constructed now that the "humps" and the "ladders" allow of the cutting up of a train with very little shifting and car coupling. Rolling stock generally is much more safely handled with modern appliances and with the modern orders prohibiting drinking while on duty. The electric lighting of yards saves the lives of many poor fellows; steel cars, improved couplers, air brakes, and other devices limit accident; and better organization improves the tone of the whole service. My observation is that the railroads are conducting the freight business probably as well as the exigencies of the case permit and the too frequent tramp "dead heads" allows. Disinfection of freight is discussed under shipping regulations.

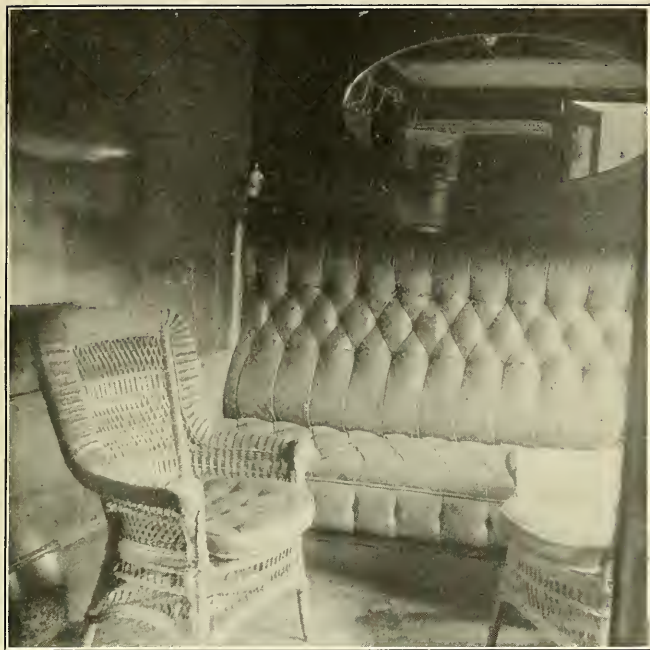
Railroad towns.—The railroad is the sole factor in the development of some towns. Where large yards or shops are needed at junction points, a town is often built by the railroad company interested in housing its men. While some of these towns are well built, the railroad is apt to keep title in the land upon which the town is built, even though individuals may own the houses thereon. Commonly, the railroad will provide a waterworks and adequately supervise the purity of the supply. In this plan, the railroads mean well, but it is hardly to be expected that they can control a very large area. In consequence, adjacent real estate is placed upon the market and *sold outright*. It is quite an attraction to most hard-working families to own land, and that little streak in human nature results in a town beside the town soon becoming larger than the original town. As this book is largely written from notes taken on the spot, I was in such a town to-day. The railroad portion is well supplied with borough water, and the superintendent of the water works told me the railroad chemist regularly analyzes the water, and that all of the water is filtered by the alum sedimentation process and the reservoir frequently cleaned. Nevertheless, the town adjacent to the railroad portion and even a portion of the latter is full of enteric troubles, caused according to local physicians by infected well water. The moral is obvious.

Rights of Way.—Where stone ballasted, there are few sanitary faults except the excreta from toilet rooms. But in the South and parts of the West, stone is scarce and sand or earth must be used as ballast. Naturally the road grows up with weeds. In California the roads use a weed-burning machine consisting of a car with a battery of powerful gasoline burners run under one hundred pounds air pressure. The car covers eighty miles a day and consumes the weeds on and along the track. Dust is laid upon some roads by oiling the right of way.

RAILWAY MAIL SERVICE

There has been much agitation in favor of government ownership of railroads, but if a government railroad in an adjoining country to the United States is to be taken as a criterion, I doubt if it would be a good plan. However, the United States Government is dependent upon corporation-operated railroads for the transportation of the greater bulk of its mail. There has been much criticism of the service, but it must be remembered that the contracting railroads differ in various parts of the country in efficiency and sanitary care. One cannot blame the government for taking advantage of the most rapid means of transmission at hand, but the government must take it much as it is and cannot very materially alter sanitary faults inherent in defective rolling stock and bad railroad management. As a matter of fact, many railroads do not pay, and it is not to be expected that boards of directors will vote large sums for the improvement of roads traversing sections giving very insufficient support.

In order to learn the attitude of the postal department of the United States, I wrote to the second assistant postmaster general, and requested information relative to the railway mail service. The reply is partially



SANITARY LEATHER UPHOLSTERY, SMOKING COMPARTMENT

SANITARY MAIL CAR
Northern Pacific Railway Company

reproduced and makes perfectly clear that the government is earnestly trying to provide for the sanitary side of the service. The enclosures noted in the letter are also reproduced.

Sir.—Replying to yours of the 6th instant, in regard to the sanitation of the railway mail service and more especially to the handling of mail during epidemics, I have to state that Section 1177, Postal Laws and Regulations, requires that

All cars or parts of cars used for the Railway Mail Service shall be of such style, length, and character, and furnished in such manner, as shall be required by the Postmaster General, and shall be constructed, fitted up, maintained, heated, and lighted by and at the expense of the railroad companies.

The word "maintained" includes the keeping of the cars in a cleanly and sanitary condition. We have no knowledge that railroad companies are willfully neglectful of their duties in this respect. Postal clerks are expected to report to their immediate officers when their cars are not kept clean, so that such cases may be taken up with the railroad companies.

As regards the handling of mail during epidemics, I enclose herewith circulars which are used in connection therewith. One treats of the disinfecting of mail by formaldehyde and the other by burning sulphur. During epidemics, especially of yellow fever in the South in years past, disinfecting camps have been established, where clerks in box cars handle the mail exposed to infection and disinfect the same before sending it to destination.

Very respectfully,

G. F. STONE, *Acting General Superintendent*

INSTRUCTIONS OF THE MARINE HOSPITAL SERVICE

AS TO THE MOST CONVENIENT AND PRACTICABLE METHOD OF

DISINFECTING MAIL MATTER

First.—Place the letters in a closed receptacle, such as a wooden box, provided with a tight-fitting lid, and sprinkle over the letters formalin or formol, which are commercial articles of a forty per cent solution of formaldehyde. Keep the receptacle closed for two or three hours, according to the amount of mail to be disinfected; the greater the quantity the longer should be the exposure.

Second.—With box as above, use a mixture of formalin or formal and sawdust, one part of the former to two parts of the latter. The sawdust can then be used in the same manner as the solution of formaldehyde. Exposure should be somewhat longer—say six hours.

Third.—Generate formaldehyde gas from wood alcohol by means of special lamps. The lamps should be capable of transforming not less than one liter of wood alcohol per hour. This method is more applicable to large quantities of mail, where the exposure can be made in a room, using not less than one and four fifths pints of wood alcohol for each one thousand cubic feet of space. Time of exposure to be not less than twelve hours.

Fourth.—Apply formaldehyde gas by means of a glass cylinder provided with a vacuum apparatus and special apparatus for generating and applying the gas. The gas should be applied in a dry state in not less than twenty per cent in volume strength, and the time of exposure not less than two hours.

If any of the above methods is employed, the letters should not be tied up in packages, but should be placed loosely in the receptacle or room, so as to leave a free access

of gas to all of the surfaces. Newspapers and packages tightly wrapped should be opened before disinfecting. Individual letters sent from places where contagious or infectious diseases exist can be thoroughly disinfected in the following simple manner: Take a small piece of blotting paper, or some other absorbent, dip it into a forty per cent solution of formaldehyde, and place it in the envelope with the letter. This method has been in practice for some time by the officers of the Marine Hospital Service in their work in smallpox cases.

SIMPLE METHOD OF DISINFECTING OR FUMIGATION OF MAILS BY THE USE OF BURNING SULPHUR

DIRECTIONS FOR DISINFECTING MAIL BY THE USE OF SULPHUR DIOXIDE GAS

Provide a box or room sufficiently large to accommodate the mail to be disinfected, spread out on racks made of chicken wire or other suitable material, so that no two letters shall be superimposed, provide another box of similar size, without any top to it, and place the first box over the second, in such manner that the fumes of burning sulphur may arise from the second box into the first through holes bored close together in the bottom of the box which holds the letters. Place on the floor of the lower box a small pot, preferably one provided with legs, in a pan of water, and in the pot an amount of sulphur equal to five pounds for a thousand cubic feet of air space in both boxes. Pour on to the sulphur a small quantity of alcohol, and after setting fire to it, place the top box into position, the letters having been previously punctured and placed on the racks. Close up all apertures tightly and allow them to remain closed for eight hours, after which the mail may be removed and distributed. In using a closet or room for this purpose, the pot may be placed in the center of the room, care being taken to provide a water pan beneath it, as above stated, to prevent accidents from fire, and the quantity of sulphur calculated on the basis of five pounds to a thousand cubic feet of air space.

The above is issued by authority of the Surgeon General of the U. S. Public Health and Marine Hospital Service, under date of February 5, 1908.

ALEXANDER GRANT,
General Superintendent Railway Mail Service

There has come to my desk a highly sensational journal published in Phoenix, Arizona, and called "The Harpoon, a Magazine that Hurts." It is "For Postal Clerks," and if half of what it says were proven to be true, the railway mail service is in a bad way. I quote a short editorial therein in the number for June, 1909:

DANGER AHEAD

The main purpose of this journal is to enunciate the principle that citizens under the Constitution do *not* forfeit their rights by entering the civil service. To hold otherwise is to invite ultimate, complete, bureaucratic control of the hundreds of thousands of public workers by the officials in charge. The gravity of the situation is realized only when we study the steady widening of governmental enterprise. Eventually the hundreds of thousands in the public service will have become millions; the railroads, the telegraph, the telephone, the mines, already are operated by the government in many countries. The ill in the system is always found in bureaucratic

control. In America the civil service is great and important. Each year it is more and more becoming the service of the officials in charge. Semi-slavery for those who serve the public is rapidly becoming the service doctrine. Unwittingly, America is putting her head into the noose of bureaucratic control. Remember the hundreds of thousands in the civil service to-day will ultimately be millions, and as the number grows larger the noose will be drawn tighter — until (as one man may by organization absolutely control an army of a million of men), the American worker will be helpless.

Civil service men! we call upon you one and all to help lay down the principle that *no* public servant is great enough to take away the least of the guaranteed rights of American citizenship of the lesser public servants.

This is one of the mild editorials, and is presented with apologies to the hosts of American citizens who have visited Washington and heard the same kind of talk from the class of "office holders" who draw small salaries for work requiring little skill unless one has snap enough to put skill into it and earn promotion. This journal is so one sided that it is beyond the mark, and yet it calls attention to so many alleged sanitary faults that I considered it worth while to look into the general question of the sanitation of the railway mail service as it actually exists. No claim is made that my investigation was thorough or extensive.

From a superficial inspection of the mail cars upon several lines of railroad, it impresses me that the cars rank equally with the other rolling stock of these same roads. The postal clerks run the same risk as to wreck as do the baggage and express crews upon the trains, since the forward cars usually suffer the most damage. There is a manifest tendency toward the use of Pullman cars and steel day coaches upon the better roads, while the mail and express cars are largely of the old wood type. However, no one is more anxious for steel mail and express cars than are the railroads themselves, and they are being built and placed in commission as fast as is practicable. I have thoroughly examined the steel car in the making, upon the road, and after being through wrecks. It is a marked advance, but is buckled up more than some persons would expect, when wrecked. To my mind, its main advantage is the lack of splintering and of telescoping when wrecked. From the railroad point of view, another advantage is that a badly twisted car can be straightened up again. The steel mail car is a splendid specimen of car construction, and the mail clerks must have a little patience, and they will find that the roads pretty generally will equip themselves with them. There is a great reduction in the danger from mail being burned, and the interior arrangement is better than in the old type of car.

From personal association with several bad wrecks, I cannot but be impressed with the fact that freight trains running upon the same or immediately parallel tracks are a menace to passenger trains, and are responsible for a large percentage of wrecks. But the fact remains that the railroads derive their main income from the freight business, and very much less from the passenger traffic. Nevertheless, some of the roads are trying to separate freight and passenger traffic to as great an extent as is possible. This is to be commended.

The public are responsible for spoiling some of the plans of the railroad companies. As an illustration, here in Harrisburg we have about three hundred and fifty miles of yard trackage and an immense volume of freight to handle. The P. R.R. and the N. C. Ry. Co. united in building a long and very costly "Low Grade Freight Line" to divert the freight into safer channels and from the congested main line. No sooner was it in proper operation than a lot of villages along the freight line demanded passenger and mail service, and have appealed to the railroad commission in an effort to compel the railroad to grant the demand. I have not talked with the railroad people over the matter, but a mere observer like myself can readily see that the railroads would lose money carrying mail and passengers upon the line, and the public and their mail matter would run a serious risk of destruction. The public should be more far-seeing in these matters and should co-operate with corporations in their efforts to promote safety and sanitation.

I find no tendency upon the part of the railroads to wilfully violate their contracts with the government mail service. It is true that employees may violate certain provisions, but it is not true that the postal clerks have no redress and dare not report irregularities upon the part of these men or the railroad; themselves, as is asserted by the sensational critics. Let one live for a while in some other countries, and he will marvel at the efficiency of the United States mail. On the other hand, passenger conductors have complained to me that the mail clerks do not obey the orders of the train as well as they should, and are themselves responsible for some insanitary conditions of which they complain.

As to special mail devices permit me to quote the ever breezy "Harpoon," and make some comments thereon.

A huge iron hook held in heavy cast sockets hangs across the mail car doorway; it is supplied with a wooden handle whereby the mail clerk may swing it up into a horizontal position so as to rake in anything within a distance of thirty inches from the car. The pouch to be "caught" is suspended on a crane, in line with the sweep of the hook. Suspended, the pouch has the shape of an hourglass — a strap being drawn about the middle with the mail in either end. This shape permits the pouch to slam back into the "v" of the hook.

That's the whole outfit for taking on mail in speed. The railroad companies graciously supply it, and the post office department seems to be satisfied. By means of this device as much as forty pounds of mail can be negotiated, provided the bottom of the pouch doesn't fly out, or the hook doesn't break off, or the clerk doesn't get such a shock up his arm that he fails to grasp the pouch as it rebounds. "Got away," he shouts to the clerk in charge, who sends back a notice to the local postmaster that "this train failed to catch Bungville to-day. Cause: bounded out."

At Bungville they're patiently searching up and down the right of way for the bits and fragments. U. S. mail is awfully sacred. . . . Knew a clerk once who tried to make a night "exchange" at Blissfield, Mich. He "caught" the bridge and threw his pouch in the river. We lost about a ten-foot section of the car wall there. It's no uncommon thing to hook the swing doors of freight cars on siding. We always shudder when we see a man stick his head out of a car window on a double track line.

When it is snowing and blowing, or steam and smoke are obliterating all view

through the glass "protector," or when the mail is thundering on through the night between strings of freight cars, the clerk who is approaching an "exchange" station must be keenly alert to every sound and sign that will give him his bearings. The roar of a road crossing is gone as quick as it reaches his ears. He leans forward ready to cast off and raise the hook. He doesn't like to swing it up in the face of that freight, from which seems to come a deafening roar. But he does; it's the only sure way not to "run by"; and, too, maybe the freight isn't "cut" one hundred and fifty feet at the station. That's the open spot he's watching for. Suddenly it flashes up. He hurls the pouch out — if a second too late it strikes the cars on the other side of the "cut" and comes back under the wheels; in the meanwhile the other pouch is raked down from the crane with a thump that shakes the car. If he doesn't reach quick, it, too, will go under. The department is trying to stop this slaughter by fining clerks.

The device for delivering mails, as you see, is more simple than the other. An open door eight or ten feet up from the ground, a train going sixty miles an hour, and a clerk who does his best to land the pouches on a soft spot. There you have it. The department and the companies have been "looking" for improvements over this method these forty years. In the meanwhile flying machines have been made an article of commerce.

Of course, the amount of mail that can be dumped off by this "device" is greater than may be taken on. Often the fast mails have two or three doors piled full of sacks for one of the larger stations, such as when they have the metropolitan Sunday papers. It requires four or five men to make the deliveries at such times. One clerk peers ahead. If it be night, or the weather be bad, the difficulties are not slight. To carry that stuff by means that some clerk will have to pay the bill for the Sunday papers, for they are worthless Monday morning. At the cry, "Let 'er go!" the men behind the piles heave mightily. The sacks are merely dumped off. A catapult couldn't hurl them off as the orders require. The men contend that they don't know how far or in what direction the sacks are going to roll, or whom they are going to hit. The department denies this.

I looked this matter up and find that the "hook" is made of malleable iron and simply bends back, as a rule, if it chances to strike a car or bridge post. There are not a great many pouches missed, but when they are they are liable to be sucked under the cars and the damage is quite as complete as described. As to catching the head of a person looking out of a passing car window, that is not probable, since the trains pass on the other side of the right of way. Occasionally a train takes the left, but not as a rule. What is said about freights and delivering Sunday papers is largely correct, I am told, by conservative men. In melodrama upon the stage this device works beautifully, and it does well in practice, as a rule, but that the device is primitive and needs to be displaced by something better appears, from my observation, to be true enough. But after I devised three plans that appealed to me, a postal clerk told me none of them would be practical, and that the right device had not yet been found.

The other equipment of the cars impressed me as sanitary, except in one detail. The mail sacks and more especially the cords with which the packages and sacks are tied are largely of cotton, and it surprised me to find that the fibers are liable to be carried all over the car and arise in the air at any time. The clerks upon a busy route are required to work very rapidly, and

strings must be rapidly applied or torn off. Some clerks claim that this cotton fiber is a serious detriment to health.

Objection has been made to the toilet arrangements and the drinking water tanks of the mail cars. From limited observation there is room for improvement, but really little directly open to criticism. I have been in a typical dormitory used by the clerks and found it quite as good as one could expect, and what little was insanitary was equally the fault of the men and of the management.

Express cars are about upon a par with mail cars and various combination cars are in service. Remarks made with reference to the mail service apply equally here, so far as sanitation is concerned.

Depots vary much over the United States. Most of them are sanitary. In Chapter II will be found a description of the Union Depot at Washington, the finest railroad depot in the world. In addition to what is there said, persons desiring information should consult the "Electric Age" for August, 1908, and the "Electrical World," for August 1, 1908. At this depot will be found a most elaborate vacuum arrangement for the cleaning of cars. One will find a good illustration there of railroad welfare work in the shape of a Y. M. C. A. and "bunk rooms," provided with baths of excellent design, as well as pool and billiard tables, card rooms, a library, and proper amusement features.

Shops are quite as well constructed and equipped, as are the roads owning and maintaining them. Mr. A. W. Gibbs, general superintendent of motive power of the P. R.R., writes me as follows:

In regard to the ventilation of our shops: All our modern shops are arranged with adequate skylights and windows which can be opened or closed at will, to provide the necessary ventilation, and we are particularly careful in constructing new shop buildings to provide the most up to date plumbing in the way of water closets and urinals, as well as wash rooms for the men to use after working hours and before they go home. The basins are white enamel or porcelain. A janitor is in charge of the wash or toilet rooms. All our modern shop buildings are either heated by direct radiation or by the Sturtevant fan system; both arrangements may be seen in the shop at this point.

Carriage of the dead.— Practically all of the states have proper provision made in this regard. One must abide by the laws of his own state or those of the place where the original death certificate was made out. From some experiences accompanying bodies I am inclined to the view that the Southern states have the most rigid regulations in this matter. I have noted some unnecessary harshness and even brutality in the enforcement of these laws.

To be brief with this subject, it is probably better to illustrate its workings by reproducing a blank. Therefore, I offer here one half of the blank in use in Vermont. The other half is a duplicate of the first, with the exception of the "Rules," and with the addition of the docket notes necessary for the filing of such a duplicate report at the office of the state board of health.

RULES FOR THE TRANSPORTATION OF THE DEAD

BY THE STATE BOARD OF HEALTH OF VERMONT

By the authority given the State Board of Health by Act No. 156 of the Laws of the Twentieth Biennial Session, 1908, the following rules and regulations have been adopted and ordered published, to go into effect on and after February 1, 1909:

RULE 1.—The transportation of bodies dead of smallpox or bubonic plague is absolutely prohibited.

RULE 2.—The transportation of bodies dead of Asiatic cholera, yellow fever, typhus fever, diphtheria (membranous croup), scarlet fever (scarlatina, scarlet rash), erysipelas, glanders, anthrax, or leprosy, shall not be accepted for transportation unless prepared for shipment by being thoroughly disinfected by (a) arterial and cavity injection with an approved disinfecting fluid; (b) disinfection and stopping of all orifices with absorbent cotton, and (c) washing the body with disinfectant, all of which must be done by an embalmer holding a certificate as such, issued by the state board of embalming examiners.

After being disinfected as above, such body shall be enveloped in a layer of dry cotton, not less than one inch thick, completely wrapped in a sheet securely fastened, and incased in an airtight zinc, tin, copper, or lead lined coffin or iron casket, all joints and seams hermetically sealed, and all enclosed in a strong, tight wooden box. Or the body being prepared for shipment by disinfecting and wrapping as above may be placed in a strong coffin or casket, and said coffin or casket encased in an airtight zinc, copper, or tin-lined box, all joints and seams hermetically soldered.

For interstate transportation, under this rule only embalmers holding a license issued or approved by the state board of embalming examiners, after examination, shall be recognized as competent to prepare such bodies for shipment.

RULE 3.—The bodies of those dead of typhoid fever, puerperal fever, tuberculosis, or measles, may be received for transportation when prepared for shipment by arterial and cavity injection with an approved disinfecting fluid, washing the exterior of the body with the same, and enveloping the entire body with a layer of cotton not less than one inch thick, and all wrapped in a sheet securely fastened, and encased in an airtight metallic coffin or casket, or airtight metal-lined box, provided that this shall apply only to bodies which can reach their destination within thirty hours from the time of death. In all other cases such bodies shall be prepared by a licensed embalmer holding a certificate as provided for in Rule 2. When prepared by a licensed embalmer as defined and directed in Rule 2, the airtight sealing and bandaging with cotton may be dispensed with.

RULE 4.—The bodies of those dead from any cause not stated in Rules 2 and 3 may be received for transportation when encased in a sound coffin or casket and enclosed in a strong outside wooden box, provided they can reach their destination within thirty hours from the time of death. If the body cannot reach its destination within thirty hours from the time of death, it must be prepared for shipment by arterial and cavity injection with an approved disinfecting fluid, washing the exterior of the body with the same, and enveloping the entire body with a layer of dry cotton not less than one inch thick, and all wrapped in a sheet securely fastened and encased in an airtight metallic coffin or casket or an airtight metal-lined box. But when the body has been prepared for shipment by being thoroughly disinfected by a licensed embalmer, as defined and directed in Rule 2, the airtight sealing and bandaging with cotton may be dispensed with.

This rule shall not apply to the shipment of bodies dead from injury where there is no claim of contagious disease prior to injury, and that such bodies may be received for shipment without embalming under proper certificate that the person died from injury.

RULE 5.— In the shipment of bodies dead from any disease named in Rule 2, such body must not be accompanied by persons or articles which have been exposed to the infection of the disease, unless certified by the health officer as having been properly disinfected.

Before selling tickets, agents should carefully examine the transit permit and note the name of the passenger in charge, and of any others proposing to accompany the body, and see that all necessary precautions have been taken to prevent the spread of the disease. The transit permit in such cases shall specifically state who is authorized by the health authorities to accompany the remains. In all cases where bodies are forwarded under Rule 2, notice must be sent by telegraph by the shipping embalmer to the health officer, or where there is no health officer to other competent authority at destination, advising the date and train on which the body may be expected.

RULE 6.— Every dead body must be accompanied by a person in charge, who must be provided with a passage ticket and also present a full first-class ticket marked "Corpse" for the transportation of the body, and a transit permit showing physician's or coroner's certificate, name of the deceased, date and hour of death, age, place of death, cause of death, and all other items of the standard certificate of death recommended by the American Public Health Association and adopted by the United States Census Bureau, as far as obtainable, including health officer's or registrar's permit for removal, whether a communicable or non-communicable disease, the point to which the body is to be shipped, and, when death is caused by any of the diseases specified in Rule 2, the names of those authorized by the health authorities to accompany the body. Also the undertaker's certificate as to how the body has been prepared for shipment. The transit permit must be made in duplicate, and the signature of physician or coroner, health officer and undertaker, must be on both the original and duplicate copies. The undertaker's or registrar's certificate and paster of the original shall be detached from the transit permit and securely fastened on the end of the coffin box. All coffin boxes must be provided with at least four handles. The physician's certificate and transit permit shall be handed to the passenger in charge of the corpse. The whole duplicate copy shall be sent to the official in charge of the baggage department of the initial line, and by him to the secretary of the state or provincial board of health of the state or province from which said shipment is made.

RULE 7. When bodies are shipped by express, a transit permit, as described in Rule 6, must be made out in duplicate. The undertaker's certificate and paster of the original shall be detached from the transit permit and securely fastened on the coffin box. The physician's certificate and transit permit shall be attached to and accompany the express waybill covering the remains, and be delivered with the body at the point of destination to the person to whom it is consigned. The whole duplicate copy shall be sent by the forwarding express agent to the secretary of the state or provincial board of health of the state or province from which said shipment was made.

RULE 8. Every disinterred body, dead from any disease or cause, shall be treated as infectious or dangerous to the public health, and shall not be accepted for transportation unless said removal has been approved by the state or provincial health authorities having jurisdiction where such body is disinterred, and the consent of the health authorities of the locality to which the corpse is consigned has first been obtained; and all such disinterred remains, or the coffin or casket containing the same, must be wrapped in a woolen blanket thoroughly saturated with a 1-1000 solution of corrosive

sublimate, and enclosed in a hermetically soldered zinc, tin, or copper lined box. But bodies deposited in receiving vaults shall not be treated and considered the same as buried bodies, when originally prepared by a licensed embalmer as defined in Rule 2, and as directed in Rule 2 or 3 (according to the nature of the disease causing death), provided shipment takes place within thirty days from the time of death. The shipment of bodies prepared in the manner above directed by licensed embalmers from receiving vaults may be made within thirty days from the time of death without having to obtain permission from the health authorities of the locality to which the body is consigned. After thirty days the casket or coffin box containing said body must be enclosed in a hermetically soldered box.

RULE 9. All rules and parts of rules conflicting with these rules are hereby repealed.

TRANSPORTATION OF DECEASED PERSONS IN BAGGAGE CARS

TO RAILROAD AGENTS, STATION, AND TRAIN BAGGAGEMEN:

You will in no case receive a corpse for transportation unless accompanied by a physician's, coroner's, or board of health certificate, also an undertaker's certificate, that the body has been prepared for burial and shipment in accordance with the rules of the state board of health, *nor will you receive it even with such certificates if fluids or offensive odors are escaping from the case.* One full first-class limited or unlimited ticket will be required for the transportation of a corpse without regard to the age of the deceased, and the word "Corpse" must be plainly written on the face of a local and on each coupon of a coupon ticket. A corpse will not be taken for transportation unless a passenger is in charge. A record must be made on the back of your station, and trip reports of all bodies shipped and carried, giving name of deceased and destination.

It will be the duty of agents and baggage agents to see that each burial case is properly marked on "Paster," giving date, and at what station shipped, point of destination, "State," number and form of ticket, name of passenger in charge, and place of residence, with name of agent. If the corpse is destined to a point beyond the initial line, the initials of each road over which it passes must be written on the paster; also the terminal point of each road at which transfer is made with the connecting line as shown on the coupons of the ticket.

You will see that the "Certificate of Undertaker" is properly filled out by him, and that the paster is properly filled out by yourself and is securely fastened on the end of the coffin box before it is put into the car, and the permit remaining you will hand to the passenger in charge of the corpse.

The whole form must be made in *duplicate*, either with a pen, carbon paper, or simplex paper, and the signatures of the physician or coroner and undertaker must be on *both* the original and duplicate copies.

The undertaker's certificate and paster of the *original* will be detached from the physician's certificate and permit and fastened on the end of the coffin box. The physician's certificate and the permit will be handed to the passenger. The *whole duplicate* copy will be sent to the general baggage agent of the initial road by first passenger train.

All this information is necessary to insure the prompt and correct transportation of the corpse.

(ORIGINAL) TRANSIT PERMIT NO.

.....Railroad

TRANSPORTATION OF CORPSE

STATE BOARD OF HEALTH OF VERMONT

Physician's or Health Officer's Certificate

Name of deceased.....Date of Death.....19.....

(If a minor, give parents' name also)

Hour of death.....M. Age.....Years.....Months.....Days.....

Place of death.....

Cause of death.....

I hereby certify that the above is true to the best of my knowledge and belief.

.....M.D. or Health Officer

Residence.....County of.....State of.....

Permit of Local Board of Health

This permit must be properly signed, and with Physician's Certificate presented to the Railroad or Express Agent before a body can be shipped.

In the.....of.....County of.....

(City or Town)

State of.....on the.....day of.....19.....

Permission is hereby given.....holder of Certificate of Registration

No.....to remove for burial at.....in the County of.....

State of.....the body of.....

who died at.....County of.....State of.....

on the.....day of.....19.....Aged.....Years.....Months.....

Days.....and.....is hereby authorized to accompany said remains.

Signed.....Local Health Officer

RULE 1. The transportation of bodies dead of smallpox or bubonic plague is absolutely forbidden.

This Permit and preceding Certificate must be detached and delivered to the person in charge of the corpse.

This Certificate and the Shipping Paster below must be detached at this perforation and securely tacked or pasted on the end of the coffin box.

PASTER

Transit Permit No.

*Certificate of Undertaker (Registered)**I hereby certify that the accompanying dead body of.....*

(If a minor, give parents' name also)

consigned to.....in the County of.....State of.....

and who died of.....has been prepared by me and strictly in accordance

with Rule.....of the State Board of Health of Vermont, for transportation by railway

and in conformity with said Rule as printed on the back of this permit, and I further

certify that I hold a certificate (No.....) of a registered undertaker and embalmer

issued by the State Board of Embalming Examiners.

.....Shipping Undertaker

Residence.....

Station baggagemen must enter hereon a description of the ticket, the exact route, and *via what functional points the ticket reads*, which is held by the passenger in charge of the remains.

SPECIAL INSTRUCTIONS.— A burial case containing a corpse must not be received for transportation unless the person in charge of the remains presents a certificate of the attending physician or coroner, a permit from the board of health, and an undertaker's certificate that the body has been prepared for burial according to the law of the state, and the rules and regulations of the state board of health. Neither will it be received if any fluids or offensive odors are escaping from the case. Agents will detach the certificate and this paster, at the perforation, and tack them securely on the end of the box before shipping.

		<i>Date</i>	
<i>From</i>	<i>to</i>	<i>State of</i>	
<i>No. of Ticket of Escort</i>		<i>Form No. of Ticket of Escort</i>	
<i>No. of Corpse Ticket</i>		<i>Form No. of Corpse Ticket</i>	
<i>Via</i>	<i>R.R.</i>	<i>To</i>	
<i>Via</i>	<i>R.R.</i>	<i>To</i>	
<i>Via</i>	<i>R.R.</i>	<i>To</i>	
<i>Via</i>	<i>R.R.</i>	<i>To</i>	
<i>Name of Passenger in charge</i>		<i>Place of Residence</i>	
<i>Signed</i>		<i>Station B. M.</i>	

SEE RULES AND INSTRUCTIONS ON THE OTHER SIDE

Section III

HEATING AND VENTILATION OF CARS*

REFERENCE has been previously made to this system. Believing the details thereof should be made public aside from technical magazines,

I wrote to the superintendent of motive power of the Pennsylvania R.R. for details. Mr. Gibbs very kindly supplied me with a copy of the road's blue book upon the subject. This book represents investigations costing nearly fifty thousand dollars, and is entirely too bulky for reproduction in its entirety. But it is of such value to those interested, that the essential portions and a few of the many drawings are here given.

Permission has been given for such use of this data.

SUBJECT: — Heating and Ventilating " P70 " Class (Steel) Passenger Coaches.

CONCLUSIONS

VENTILATION " P70 " COACHES (STEEL)

1. When the car is in the middle of the train the ventilation is more uniform throughout the car than when the car is at either the front or rear end of the train.

2. With the car in the middle of the train, and with one and one half inch pipe radiators and eight-inch Globe ventilators, the volume of air entering the car at full

*By the Pennsylvania Railroad System.

speed of the train (forty-five to fifty-five miles per hour) is, for three trials, 65,448, 69,336, and 64,800 cubic feet per hour.

3. When eight-inch Royal ventilators were applied, the volume of air entering the car was 46,656 and 53,784 cubic feet for two determinations. The car was at the front end of the train when these determinations were made, and to compare with these results we have, for the eight-inch Globe ventilator with the car at the front end of the train, 58,310 and 49,238 cubic feet per hour.

4. With Globe ventilators, having spherical instead of flat tops, the air admission was 81,000 cubic feet per hour compared with 69,336, the highest result with flat top ventilators under similar conditions.

5. With ten-inch Globe ventilators and the car in the middle of the train, the air admission is 100,446 and 88,776 cubic feet per hour for two observations.

6. With flattened pipe radiators and ten-inch Globe ventilators the air admission is 85,536 cubic feet per hour.

7. With cast iron ribbed radiators the air admission is found to be about the same as with the four wrought iron pipe radiators.

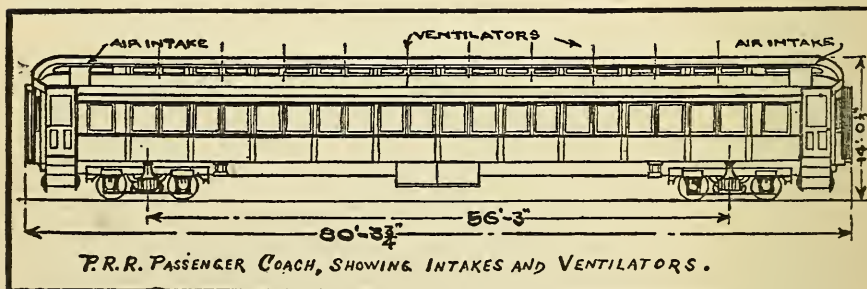
8. When the car is filled with smoke the air is completely cleared in from five to seven minutes at full speed. This would indicate that there are from eight to twelve changes of air per hour, but tests with anemometers indicate sixteen changes of air per hour. It is probable that part of the air changes oftener than sixteen times per hour, and other parts as little as eight times.

9. The class "P70" coaches appear to be ventilated as was originally intended, namely, they furnish one thousand cubic feet of fresh air per passenger per hour.

HEATING "P70" COACHES (STEEL)

10. When the temperature of the outside air is about 65 degrees F., two steel coaches Nos. 1664 and 1666, when run in the same train with wooden coach No. 1216, class "Pk," show a temperature of about 35 degrees above the outside temperature, while the wooden coach shows a temperature of 50 degrees above the outside air. The three cars were equipped with wrought iron pipe radiators without end radiators, and the steam pressure in the radiators was about fifteen pounds.

11. When the outside temperature is 93 degrees F., coach No. 1673, class "P70," with wrought iron pipe radiators without end radiators, shows a temperature of about 32 degrees above the outside air.



12. With a temperature of 85 degrees outside, coach 1673 in the same condition as above, but with ten-inch ventilators instead of eight-inch, shows a temperature 35 degrees above the outside air.

13. The same car (1673) with flattened pipe radiators and without end radiators, with ten-inch ventilators, shows a temperature of 42 degrees above the outside, when the outside air is about 74 degrees F.

14. Coach No. 1254, a wooden coach of the "Pk" class, with cast iron ribbed radiators and Bundy loop radiators, on a number of trials, shows a temperature at the center seat of about 60 degrees above the outside temperature when the outside air is at about 60 degrees F. The end temperature of the coach will be about 5 degrees lower than at the center.

15. Coach No. 1673 (steel), with cast iron ribbed radiators as shown on drawing No. R1, diagram No. 2, and the vapor system of heating shows a temperature at the center of about 35 degrees above the outside air when the outside air is about 60 degrees F. The same car without any change except high pressure instead of vapor traps, shows a difference of temperature of 55 degrees when the pressure in the radiators is about thirty-five or forty pounds per square inch.

16. Coach No. 1673, class "P70," when completely equipped with cast radiators, including end radiators as shown on R1 diagram No. 3, shows temperatures at the ends equal to or higher than at the center, when the coach is in service with frequent opening of the doors. The outside temperature has not been low enough to determine if the coach as a whole has sufficient radiating surface. The trials in moderate temperatures, with high pressure steam (thirty to forty pounds pressure in the radiators), would indicate that the coach has sufficient radiating surface when fitted as in R1 diagram 3.

HEATING AND VENTILATING CLASS "P70" COACHES

17. A number of modifications of the heating and ventilating arrangements have been made on class "P70" steel passenger coach No. 1673 with results as shown on the attached prints and diagrams.

18. This car No. 1673 was taken as representative of the steel passenger cars now building (1908).

19. The car was examined before the tests were begun (July, 1908), and it was found in the following condition. There are four ventilating intakes, one at each corner of the car roof. Each intake for air has an airduct running down the end of the car and under the car floor to the center. The airduct under the floor is divided at the center of the car so that each air intake delivers air for one half of the length of the car and not for the whole length, as in the older two-intake system of ventilation.

20. The valves in all four of the intake hoods were examined and found to be in operative condition, and to correctly register their positions by means of the rods on the inside of the car.

21. In the first series of tests the car had radiators made up of four one and one half wrought iron pipes, and it had no additional end radiators.

22. After passing through the passages and over the radiator pipes, air enters the car through ducts or "guns" under the seats, and it is discharged from the car through ten ventilators on the roof.

23. In the first series of tests the ventilators were eight inches in diameter, Globe ventilators. Later they were changed to Royal ventilators of the same diameter, and still later to ten-inch Globe ventilators.

24. In the tests to determine the volume of air entering the car through the ventilating system, no steam was turned on the radiators, but tests were made later of the heating system.

25. To measure the air entering and being exhausted from the car, a set of four anemometers or air meters were used. These were placed in the "guns" or ducts

under the seats, and the velocity of the air entering the car measured only when the car was running at from forty-five to fifty miles per hour. No exact determination of the speed was made, however. The air meters used were six inches in diameter, and as they completely filled the opening in the airduct, and considering the fact that duplicate readings could be obtained with a constant speed of the train, it is thought that the air velocity readings are sufficiently accurate for all practical purposes, and correctly show the velocity of the air entering the car, the error, if any, being in their not showing a high enough velocity due to their slightly obstructing the air passages.

26. The velocity of the air being exhausted by the roof ventilators was not so easily measured, but comparative and fairly accurate determinations could be made by holding a large air meter just under the ventilator grill inside of the car.

27. In the air passages at the ends of the car holes were cut so that the velocity of the air coming down from the air intake could be measured.

THE TESTS OF THE VENTILATING SYSTEM

THE POSITION OF THE CAR IN THE TRAIN

28. The first trials made with the car, see diagrams V1, V3, V4, (only V3 reproduced here), indicated that when the car was placed at the front end of the train, air came in through the intakes in much greater volume at the rear end of the car than at the front end, and that when the car was run at the rear end of the train the larger volume of air came in at what was then the front end of the car.

29. In order to trace out further the influence of the position of the car in the train, trials were made with the car in the middle of the train, see diagrams V10, V11, V12, V13, V16 (only V10 reproduced), and from these trials with the car at various places in the train it is evident that when the car is in the middle of the train or when there are other cars both front and back of it, air is admitted in about equal volumes at each end of the car or the ventilation is fairly uniform throughout the car. As a rule, there are baggage, express, or postal cars at the head of the train, and Pullman cars at the rear. The passenger coach is in the middle of the train, or the place most favorable for ventilation. In later tests made with this car it was placed in the middle of the train.

30. It was not at all times possible to determine the direction of the prevailing wind, but in those cases where the wind was strong, its effect upon the car ventilation was easily traced. Diagram V6 shows that the wind may increase the volume of air entering on one side of the car at the expense of the other side.

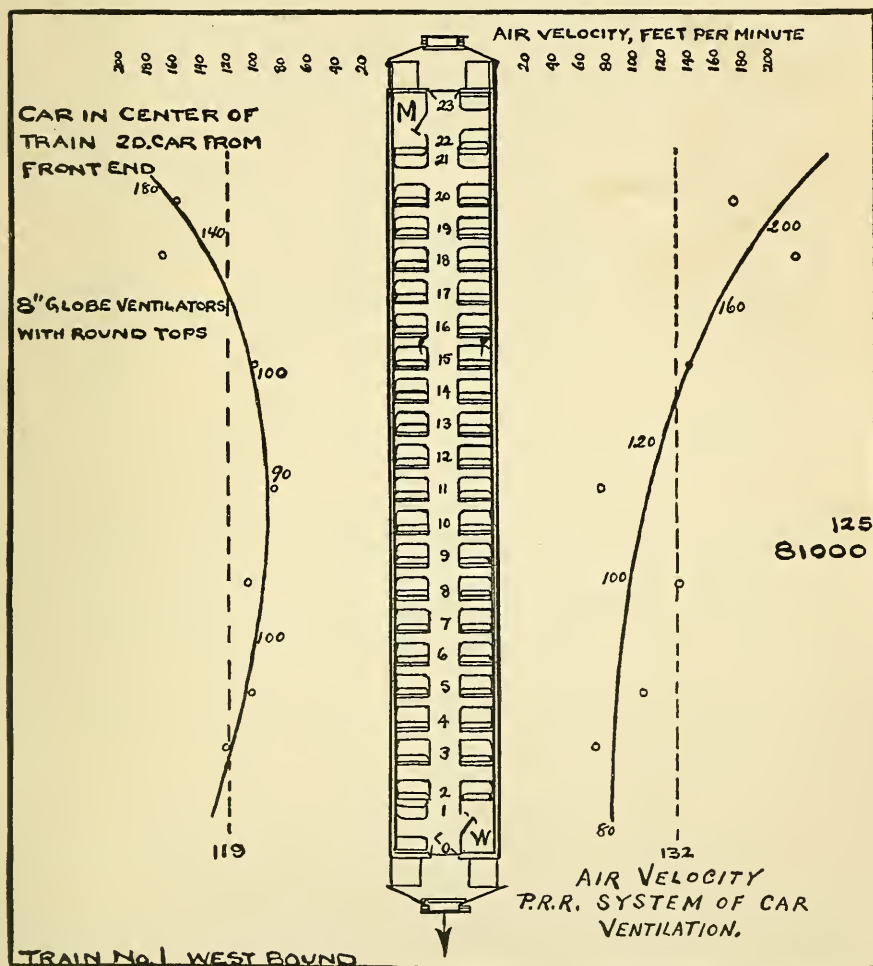
31. At the end of each airduct under the car there is a cinder trap, and in these traps cinder deflectors. These deflectors were in place when tests shown on diagrams V1 and V2 were made, but as the deflectors appeared to greatly obstruct the air passages they were removed and tests V3 and later tests made without them.

32. In test V1 the average velocity of the air is sixty-two feet per minute entering the car, while under like conditions in test V3 with the deflectors removed, the average velocity is ninety feet per minute.

33. The volume of air that has been determined upon as sufficient for ventilation is 1,000 cubic feet per passenger per hour. The "P70" car would then require 88,000 cubic feet of air per hour, as it has seating capacity for eighty-eight passengers.

34. With the car in the center of the train and at a speed of over forty-five miles per hour, the volume of air entering the car under normal conditions was found to be about 65,000 cubic feet per hour, see diagrams V10 to V13 inclusive. (Only V10 reproduced.)

35. This is not a large enough volume of air. While this volume of air was coming into the car, the roof ventilators appeared to be exhausting about 23,600 cubic feet per hour, or less than half the volume entering. It was decided to increase, if possible, the exhaust side of the ventilating system and in place of the eight-inch Globe ventilators, eight-inch Royal ventilators were put on. A trial with these gave lower results than with the Globe ventilators. In test V15 at fifty-three miles per hour the Royal ventilators exhausted but 14,400 cubic feet per hour.



36. Laboratory tests of an eight-inch globe and an eight-inch Royal ventilator were then made. By the use of a ventilating fan air was blown against each ventilator at about 2,000 feet per minute or about twenty-two miles per hour. Under these conditions the Globe ventilator exhausted air at the rate of 127.4 cubic feet per minute, while the Royal ventilator exhausted air at the rate of 98.8 cubic feet per minute. With the two kinds of ventilators on the car (ten of each), the Globe ventilators would exhaust a total of 76,431 cubic feet per hour, and the Royal 59,260 cubic feet.

37. The eight-inch Globe ventilators were replaced on the car, but with their tops made spherical instead of flat. A test with these spherical topped ventilators, V16, shows a volume of air of 81,000 cubic feet per hour entering the car, a considerable increase over all former tests.

38. The volume of air entering the car was still too small and larger Globe ventilators were put on the roof. These ventilators were ten inches in diameter.

39. Tests shown on V17, V18, and V19 (V17 given) indicate that the larger ventilators increased the flow of air into the car. A volume of over 100,000 cubic feet per hour was obtained with them at high speeds.

40. The results in regard to ventilation appear to be satisfactory, as it is evident that more than 1,000 cubic feet of air per passenger is obtained.

Volumes of Air Entering Coaches when running at 45 to 50 M.P.H.
Cubic Feet per Hour

Class "Pk" Wood Two Air Intakes 6 inch Ventilators	Class "Pk" Wood Four Air Intakes 8 inch Ventilators	Class "P70" Steel Four Air Intakes 8 inch Ventilators	Class "P70" Steel Four Air Intakes 10 inch Ventilators
53,946 60,264	90,720 99,540	38,102	88,776 100,446

RETARDATION OF AIR CURRENTS BY SCREENS

41. In order to determine the effect of the screens on air intakes and in ventilators, some trials were made with wire screens of different mesh. A large electric fan was used. The velocity of a current of air from the fan was measured by means of an air meter and when uniform conditions were established a wire screen was placed in the air current between the fan and air meter and a velocity reading made of the current of air flowing through the screen. The following table gives the results obtained.

42. The first few cars of the "P70" class had screens in the Globe ventilators, but these were omitted on the later cars. The intake hood is covered by a screen having eight meshes per inch.

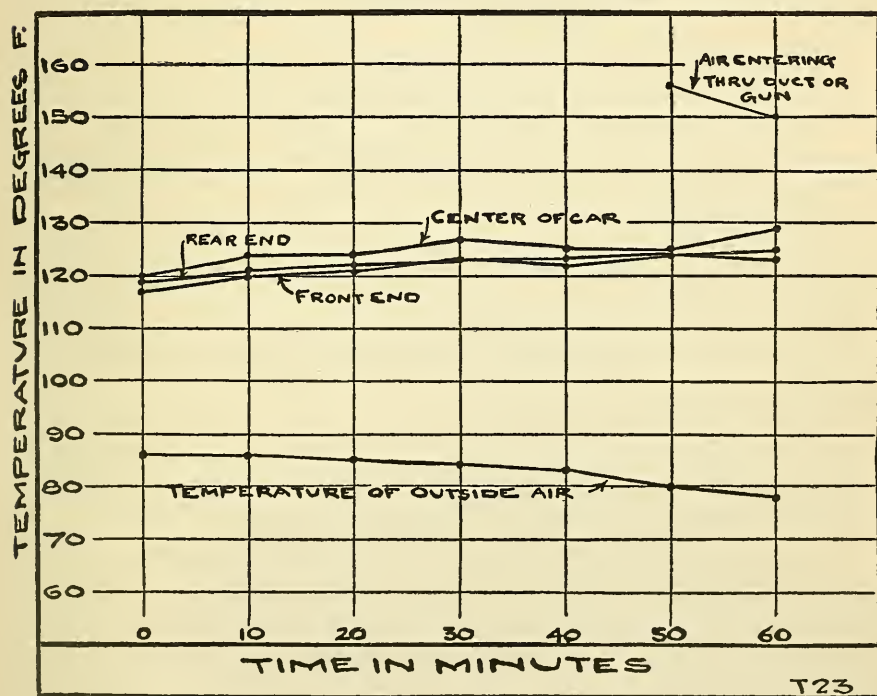
HEATING

44. The first order of "P70" coaches (steel) have been built (1908) with steam radiators of the indirect type, consisting of four wrought iron pipes one and a half inches in diameter. These pipes are straight and extend a few inches beyond the end bulkheads, see drawing No. R1 diagram No. 1. The radiators are arranged for steam under pressure and some cars have "Consolidated" and others the "gold" steam trap.

45. On June 17, 1908, two steel coaches, Nos. 1666 and 1664, and a wooden coach, No. 1216, were run in the same train to observe the effect of the heating arrangements. The coaches were two class "P70" with wrought iron radiators and two-intake ventilating system. The wooden coach was a "Pk" class, with the same kind of radiators, but with the older two-intake ventilating arrangement. This latter coach had been selected as one that had given good heating during last winter (1907-1908).

RADIATING SURFACE IN P. R. R. PASSENGER COACHES

<i>Class of Coach</i>	<i>Form of Radiator</i>	<i>Area of Radiating Surface — Sq. Ft.</i>
Pk	Cast iron ribbed single pipe with Bundy loops under seats. No end radiators.	244
Pk	Four 1½ inch wrought iron pipes. No end radiators.	200
PL	Four 1½ inch wrought iron pipes. No end radiators.	261
P70	Four 1½ inch wrought iron pipes. No end radiators.	240
P70	Four 2 inch pipes flattened. No end radiators.	300
P70	Four 2 inch pipes flattened. With four end radiators.	392
P70	Cast iron ribbed radiators, single pipe, 34 Bundy loops and 4 end radiators.	553
P70	Cast iron ribbed radiators, double pipe. Four end radiators.	430
P70	Cast iron ribbed radiator, single pipe, 34 Bundy loops, 4 end radiators and in addition 4 radiators outside of bulkhead.	610
P70	Four wrought iron pipes, with additional end radiators.	328



46. The cars were coupled with the wooden car between the two steel cars and a trip from Altoona to Harrisburg and return with steam on the radiators. Temperature readings were made at intervals of ten minutes. Care was taken to have the heating and ventilating arrangements in proper working condition.

47. On diagrams T1, T2, and T3, the observed temperatures are shown for the Eastbound trip and on diagrams T4, T5, and T6 the Westbound trip.

48. On both the Eastbound and Westbound trips the temperature in the wooden coach No. 1216 was as much as 50 degrees F. above the outside air, while the temperature in the steel coaches under the same conditions was never as much as 35 degrees F. above the outside air.

49. A later trip made with a "P70" coach No. 1673, with wrought iron pipe radiators and four-intake ventilating system, or the same as coaches 1664 and 1666, but with spherical top ventilators, gave results as follows: On the Eastbound trip the car was heated and the temperature was 32 degrees F. above the outside temperature. See diagram T13.

50. Another trip with this car No. 1673 equipped as before but with ten-inch Globe ventilators shows a temperature of 35 degrees F. above the outside air.

51. A number of trials of wooden coaches No. 1536 and 1216 during last winter, show that they can be heated at the middle part to a temperature of from 45 to 50 degrees above the outside air without difficulty. There is then a deficiency in heating effect, with the steel coaches having the four-pipe radiators.

52. Various volumes of air entering through the ventilating system have been observed under different conditions with the steel coaches, but it has not been possible to heat them to a temperature of more than 35 degrees F. above the outside air.

Owing to difficulty in reproducing prints, few appear. — T. S. B.

TEMPERATURES AT CENTER AND ENDS OF COACHES

53. It has been noticed in all of the tests of the heating of both steel and wooden coaches that the temperature at the center of the coach is from 5 to 15 degrees higher than at the end seat.

54. This difference in temperature is due in part to the ventilation. There is more air delivered to the ends by the ventilating system than to the center. In addition, the doors at the ends of the cars admit some air when closed, and the end of the car is rapidly cooled when the doors are open. The end of the car requires more heating than the center to maintain its temperature, whereas now (November, 1908) it is not so well heated as the middle of the car, where there is additional radiating surface in the steam supply pipe and drain.

55. Diagrams T101 to T105 (not shown here) show temperature readings made when the cars were not heated. In these the center temperature is slightly higher than the ends. This difference in temperature can be equalized by a redistribution of radiating surface, and later trials have shown that this has been accomplished.

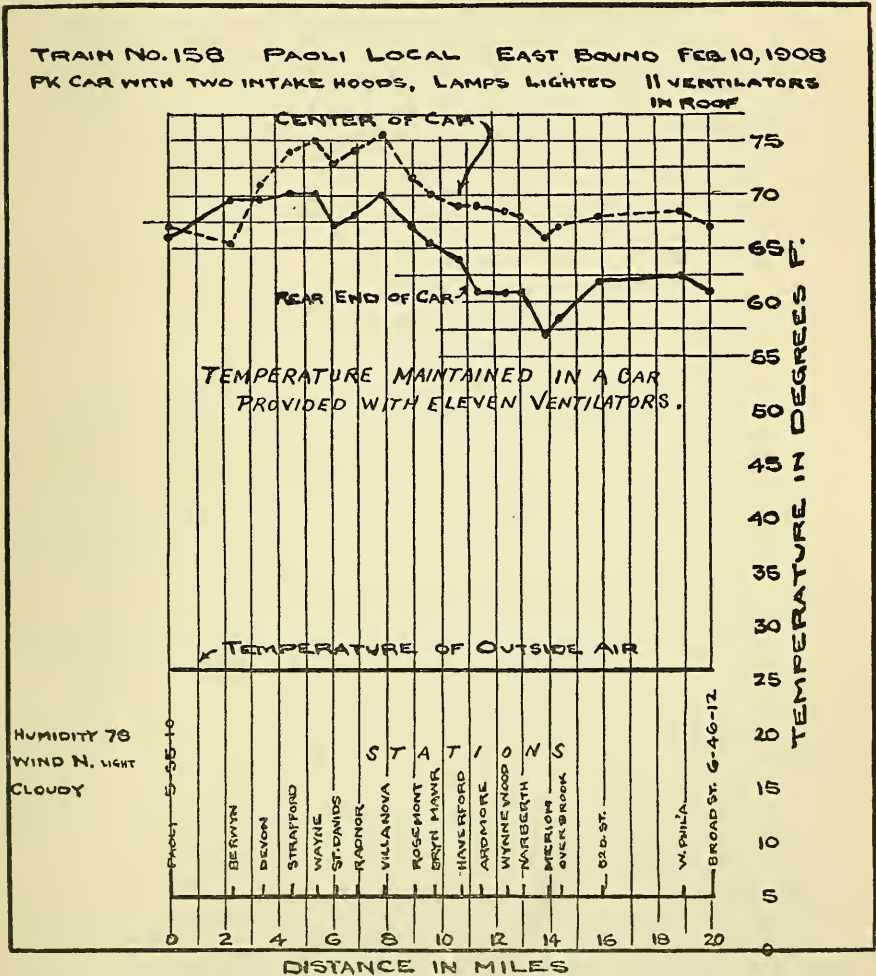
56. As the radiating surface of the steel cars had been found to be too small, it was decided to put in larger radiating pipes. Two-inch plain pipes, while they could be put in, would be so close together as to obstruct the air passages. To allow the air to flow freely over the pipes, they were flattened, as shown in the photographs attached.

57. The heating surface of the radiator made up plain of one and one half inch pipes is about two hundred and forty square feet for the "P70" cars, and the surface with the flattened two-inch pipes is about three hundred square feet, an increase of twenty-five per cent.

58. A trial was made with the flattened pipes and the temperature record is shown on diagram T15. There is a slight increase in temperature, but not what might have been expected from the large increase in radiating surface.

CAST IRON RADIATORS

59. To obtain a larger heating surface than can be obtained with wrought iron pipes, cast radiators were designed, as shown on drawing R2. The older type of cast radiator has four bolts at each joint, and two of these are inaccessible for drawing up if the joint should leak. The new radiators were made with a single bolt joint, with the nut on the side toward the center of the car. These bolts can be tightened after



the radiator is in place in the car. Two coaches, No. 1673 and 1802, were fitted with these cast radiators. Coach 1673 with the single pipe type as shown on R2, and 1802 with a very similar radiator, but one having two pipes instead of the single pipe. These radiators, as first applied, had end radiators, as shown on R1 diagram 2, and both had the Chicago Car Heating Company's vapor traps.

60. A trial of car No. 1673 on October 17, 1908, when the outside temperature was 83 degrees, shows a temperature at the center of the car 32 degrees above the outside, with the end temperature 4 degrees below the center.

61. On November 3, 1908, this car with pressure traps shows a difference of temperature between the inside and outside of 46 degrees and 52 degrees for two trips, but still with a difference between the end and center of 8 degrees to 10 degrees.

62. Car 1802 with cast radiators and the vapor system gave practically the same results as No. 1673, with the vapor system. That is, a difference of temperature of about 35 degrees. Car 1802, with double pipe cast radiators and without Bundy loops, had less radiating surface than No. 1673. Car 1673 was then changed back to the vapor traps and additional radiating surface placed in the ends, as shown on drawing R1, diagram 3, while car 1802 had the Safety Car Heating & Lighting Co.'s radiators and traps put in. A trial of these two cars was then made between Pittsburgh and New York, and the results are given in the letter dated November 23, attached to this report.

Test Department, Altoona, Pa.

(Copy)

ALTOONA, PA., November 23, 1908

SUBJECT: CAR HEATING AND VENTILATING

MR. A. W. GIBBS,

General Superintendent Motive Power.

Dear Sir: Coaches Nos. 1673 and 1802 have been equipped with heating arrangements according to the program decided upon at the last conference on heating and ventilating steel passenger cars.

Coach 1673 has cast iron ribbed radiators of the new type, with single bolt joints. The radiators are of the single pipe style. The radiators have been extended up to the end of the car. The Chicago vapor traps and regulating valves have been applied. The deck ventilators are ten inches in diameter. The heating arrangement of this car, No. 1673, is shown on drawing No. 31,384. (Not given here.)

Coach No. 1802 has been equipped with the Safety Car Heating & Lighting Co.'s system of radiators and traps. The radiators in this car consist of two-inch wrought iron pipe, with a cast iron ribbed radiator at each corner of the car. The cast radiator is an extension of the two-inch pipes. The radiator for one quarter of the car is so arranged that the steam flowing from the center of the car must traverse the four pipes of the radiator in turn, and not in multiple, as in the four-pipe radiators in the majority of the steel cars.

These two cars were taken to Pittsburgh on the 18th instant and placed in train No. 10, together with steel car No. 1801, which has the regular four-pipe heating system, with no end radiators.

On a trip with these cars from Pittsburgh to Jersey City the following observations were made:

At the starting time, 4.55 p.m., the outside temperature was about 46 degrees. The cars had been heated thoroughly before starting, and the admission valves were open wide on each of the cars. Temperature readings were made at the middle seat and at the rear seat, just inside of the bulkhead. These readings were made at ten minute intervals in one car for a half hour, and then the same observations made in each of the other cars for a half hour. Care was taken to have the ventilating hood valves properly set, and all of the deck ventilators open. As the cars were in service it was not possible to have the doors and windows kept closed at all times.

On the trip from Pittsburgh to New York temperature readings were made at five different times on each car, or a total of two and one half hours, twenty readings being made. At the center seat the average of these temperature readings was for car No. 1802, 83.0 degrees, while at the end seat inside of the bulkhead the temperature was 76.4 degrees F., a difference of but 6.6 degrees between the center and end of car. The outside temperature was about 43 degrees F.

On car No. 1673 under like conditions the average temperature at the center was 81.2 degrees F., while at the end seat it was 79.2 degrees, or a difference of but 2 degrees between the end and the center. This car has a larger proportion of the radiating surface at the end of the car than is the case with car 1802.

On coach 1801 one hour was spent in reading temperature, with the result that the temperature at the center of the car was found to be 83.7 degrees, while at the end seat it was 68.2 degrees, or a difference of 15.5 degrees between the center and end.

On the return trip from Jersey City on train No. 3 there was no coach with the regular four-pipe heating system.

On coach 1802 the average temperature at the center was 79.1 degrees, and at the end 74.1 degrees, or a difference of 5.0 degrees.

On coach 1673 the temperature at the center was 81.9 degrees, and at the end 78.8 degrees, or a difference of 3.1 degrees.

The temperature outside was not low. It did not fall to freezing during the entire trip, so that it was not possible to determine the results that would be obtained in very severe weather.

These two cars, 1673 and 1802, have been fitted with wood window sills and compared with car 1801, which does not have these wood sills. There is a marked difference in the apparent temperature when the hand or arm is placed on the window sill. While the actual temperature of the steel and the wood-covered sill are, no doubt, alike, the heat absorption from the hand is much slower with the wood-covered sill, and the sensation of cold to the touch is so much less with the wood cover, that it would appear to be well worth while to consider the comfort of passengers in this matter and apply these sills or their equivalent to all steel cars.

The trainmen report a frosting over of the inside of the cars in very cold weather, but on this trip there was nothing of this kind observed. Frosting would not be expected in a temperature above freezing, so it is not possible to state the results that will be obtained in this regard with these cars in very cold weather.

Yours respectfully,

(Signed)

E. D. NELSON,
Engineer of Tests.

Section No. IV

TROLLEY, ELEVATED, AND SUBWAY LINES

THE development of electric transportation has been phenomenal, and it is one of the potent elements for the promotion of public health. I remember watching one of the earliest trolley constructions and it was a wonder that the public tolerated the line. A double row of unsightly poles lined the street, and suspended between each pair of poles was a timber carrying two wires. The view down the street was obstructed by these suspended wooden bars placed at all heights and angles, and the whole affair was the most horrid in appearance of any public service I ever saw.

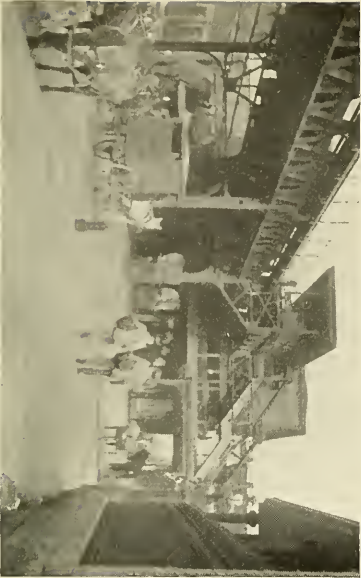
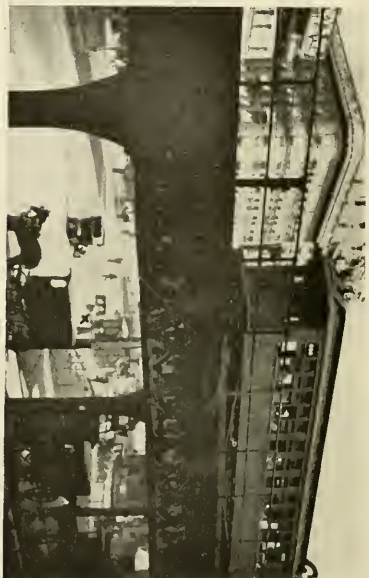
In sharp contrast to this is the surface car system in Washington, D. C. Here the wires are under ground and a device similar to a cable slot and grip conveys the current to the motors. The so-called "third rail" system of power transmission or a side-bearing shoe are used on elevated and subway roads. These latter would both be dangerous if used upon surface lines; on elevated and subway lines none but employees, who know the danger, are liable to come into contact with the electric conducting mechanism. The writer has carefully examined all forms of power transmission in common use, and believes that the safety of the public is conserved by these methods even more effectively than by the overhead trolley system. This latter is now so developed that it is possible to prevent accident, except from storm, fire, and great violence, except to the extent incident to the well-regulated control of any potent force. The greatest danger of the trolley wire is from *other wires* falling upon it. This is a constant menace not solved as yet, except to demand that telephone and other wires be so well erected as to be little liable to fall.

How electric transportation may serve public hygiene is best presented by illustration. Nearly all of the cities have parks and rural resorts inaccessible, except by some cheap means of transportation. This the trolley supplies, and the sum total of human joy and fresh air benefit conferred upon city dwellers by this "poor man's carriage" is almost beyond computation. Thousands of farms are benefited by the farmers and their families being enabled to be in contact with the city markets and the city advantages. Thus are the people knit together, and urban and suburban advantages are shared in common.

At Cleveland I was particularly impressed by the fact that trolley milk deliveries brought the milk from the farms to the city in a fraction of the time taken by wagon delivery. Think of the benefit that it is to bottle-fed babes. Many rural sections have better mail facilities, can reach the physician quicker, can procure a supply of fresh meat, can get drugs and other emergency materials more promptly, and in many of the amenities of life conditions are improved.

Between Norfolk and Virginia Beach a standard gauge track is laid that carries trolley cars by day and delivers and removes freight cars by night. This affords a lot of little stations prompt freight service, as the cars are loaded where the produce is grown and are soon on their way to the New York market. Between Mechanicsburg and Dillsburg, Pennsylvania, a steam road has long been operated, and runs a couple of trains a day. Recently it has been trolleyized, and the frequent cars are free of smoke and are just as fast as were the former locomotives. The same cars are used as formerly and the locomotive carries freight at night. The trolley wire is placed at one side of the track so as not to interfere with the freight crew walking the tops of cars. Such service is given now to hosts of little places, and the sanitary benefit in securing prompt delivery of produce is a very great advantage.

In western New York I have seen heavy freight trains moved by electric locomotives; the Pennsylvania Railroad is planning to run our freight yards electrically. As there is over three hundred miles of yard trackage in and



IN THE PHILADELPHIA SUBWAY
THE PHILADELPHIA ELEVATED R.R.

NEW YORK CITY ELEVATED R.R.
PHILADELPHIA ELEVATED—SIDE-BEARING CONTACT RAIL.

around Harrisburg, the absence of smoke from scores of shifting engines cannot but be to the sanitary advantage of the city. Tunnels such as they have under Baltimore should be supplied with electric locomotives exclusively.

The wholesale places lining Smithfield Street in Pittsburg are a fair illustration of the disadvantages of freight deliveries in a congested section. Detroit handles some of that sort of thing by trolley freight, but Chicago has a better system, viz., electrically operated tunnel cars. The eminently satisfactory subways for passenger service in New York and Philadelphia will inevitably lead to the construction of many more such public conveniences. If means were found to make the operation of elevated roads more quiet, the public would appreciate the advance. The new Market Street elevated in Philadelphia runs comparatively quiet, but what it will do after a few years' wear and tear remains to be seen; certain it is that electric motors do not wear track as does the steam engine, and so are more quiet. Were it not for flat wheels upon cars, there is no especial reason why electric cars should be so very noisy, unless it be what is called "the transmission" in an automobile. Electric cars are run on a gear transmission. If they were direct connected they would be less noisy, but there are mechanical difficulties, I understand.

Power houses, shops, car barns, and stations connected with trolley systems are often far from hygienic, but the immense development of such systems are making necessary the construction of the most substantial structures. Most of them are now being built with due regard to sanitation.

The cars themselves should be kept clean, have vestibuled ends, be adequately lighted, and be well heated in winter. Electric heating is most hygienic, but is expensive, the current used to heat three cars being equal to that required to run one car. Spitting upon the floor is almost universally prohibited in cars. Just how much the passengers are protected depends largely upon public sentiment. When trolley cars run through dusty streets, a trolley sprinkling tank car should be required during weather making it an advantage.

In order to present definite practice in trolley car sanitation, I asked the Interborough Rapid Transit Company of New York city to tell for us what they do in order to promote sanitation. Mr. Frank Hedley, vice-president and general manager of the company, sent to me a typewritten copy of an address delivered by himself on the evening of January 2, 1909, at the American Museum of Natural History, New York city, at a meeting of street railway employees at the International Tuberculosis Exhibition, held under the auspices of the Committee on the Prevention of Tuberculosis of the Charity Organization Society. It gives me pleasure to quote Mr. Hedley at length, and not only give added publicity to his excellent address, but also commend the example of his company to others less energetic in the sanitation of their cars:

We have about two thousand cars which can be compared with moving houses on wheels. We have about two hundred station buildings with the necessary ticket offices, waiting-rooms, toilets, station platforms, and stairways, that are being daily

used and occupied by 1,700,000 people. Therefore, the Interborough Rapid Transit Company's housekeeping job is to keep these cars and buildings in a clean and sanitary condition.

These car floors are thoroughly swept out every night and are sprinkled with a five per cent solution of carbolic acid. After the cars have been swept, cleaned, and time is given for the dust to settle, we then wipe up or dust with a damp cheesecloth, and do not use feather dusters in any way whatever, as it has been determined a long time since that the stirring up of the dust by the use of feather dusters was injurious to the health of the people. The floors of the cars each week, and sometimes more often, are scrubbed with soft soap containing a strong solution of alkali, and the car straps are frequently treated with an acid solution.

All of our station buildings which I have referred to and stairways are scrubbed and cleaned frequently. In some of the stations where large numbers of people assemble it is necessary to clean and mop the floors several times a day.

The speaker appreciates that it is practically impossible to change the habits of a person, and what they are accustomed to do at home they will do elsewhere. I therefore appeal to the ladies and trust you will circulate it among all your friends that if you insist on the habits of the coming generation in your homes being good plain commonsense habits, it will very largely assist the managers of the transportation companies in keeping their cars clean, their stations clean, and in other words, handling their housekeeping job in a way that will be more satisfactory both to the people and to the management than it is to-day.

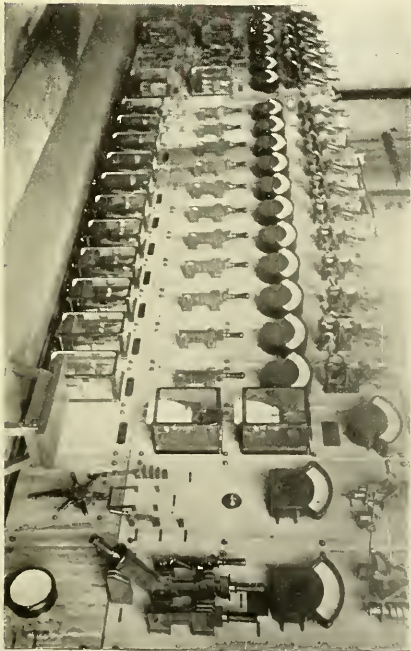
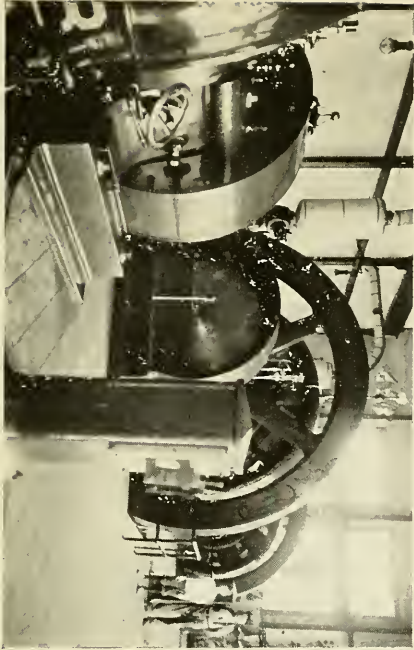
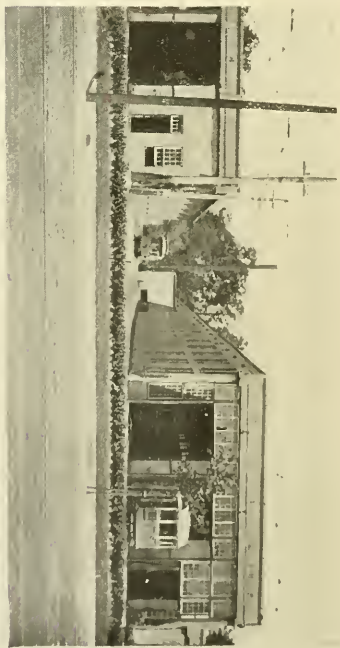
The speaker has long since recognized that we can keep our cars and the stations just as clean as our tenants, or passengers, will permit, and, as a matter of fact, the railroad company which I represent is doing everything in its power to have its cars and stations at all times clean and well ventilated, and while we do not ask our tenants, or passengers, to help us keep these cars and stations clean, we do ask them not to make them dirty unnecessarily.

A great deal has been said in the past by the public press referring to subway air, and on this I want to say a few words. We have on the Interborough System a voluntary sick and death benefit association, and the majority of our employees are members. This association pays to the sick or injured employee a daily sum during the time that the employee is disabled either by sickness or accident. It is interesting to note that our records show that we have more sick men who are employed on the elevated division than we do on the subway division, in fact, we have paid out more than twice as much money from this organization to elevated sick men than we have to subway sick men.

Some time ago I caused one hundred men employed in the subway to be examined physically by physicians, with the view of determining what change had taken place in the physical conditions of these men after they had been continuously employed in the subway for one year. The result was very gratifying, and showed that each one of the men examined was in first-class physical condition, and had increased in weight from four to forty pounds.

The matter of the alleged bad condition of the subway air has also been exploded by a very thorough examination and report made by Professor Soper, who caused a large number of samples of this subway air to be taken and carefully tested, and analyses were made of the same, which resulted in a fact being established by Professor Soper's report, which is now a matter of public record, that the air in the subway is less injurious to the public health than the air on the streets of New York.

Returning for a moment to the car equipment on the subway and elevated, I call attention to the fact that our designing car engineers in our new car equipment



A WELL-CONSTRUCTED SUBWAY UNDER A RAILROAD
AN IDEAL SANITARY ELECTRIC POWER STATION

A MODERN REINFORCED CONCRETE CAR BARN
A SAFE SWITCHBOARD, RUBBER MAT AND INSULATED STOOL

are giving special attention to the arrangement of the interior trim on these cars so as to make the construction as simple as possible, and still be attractive to the eye, and eliminate a lot of unnecessary mouldings upon which dust and microbes might accumulate. Some years ago all of the elevated cars were equipped with mats made from cocoanut fiber. These mats when new presented a very neat, clean appearance, but they soon were devoid of this newness and were veritable nests for microbes and filth.

The employees engaged in cleaning the car equipment and handling these mats were often on the sick list, and complained to the speaker personally a number of times, stating that it was a hard job handling those car mats, and after a man had worked at it for a short while he usually showed the effects. The speaker has the distinction of having installed in an elevated car several years ago the first wood strips secured to the bottom of the car in lieu of the mats. The railroad company was at that time accused of putting in the wood strips because they were cheaper. This cheapness, of course, was an advantage, but nevertheless it was an installation that very materially relieved the dangers that the employees were subjected to by the use of the cocoa mats.

Section No. V

DOCKS AND HARBORS — SHIPPING REGULATIONS

THE United States is peculiarly fortunate in its harbors and docks. We require very few expensive masonry basins or docks with a fixed level of water maintained by means of gates and machinery and which limit the passage of vessels to certain stages of the tide. Such inland docks are common in Europe, and due to the great tidal range. The following data as to the width of rivers and tidal range emphasize the difficulties of the European ports:

London	Width of Thames,	1,400 ft.	Tidal range,	24 ft.
Liverpool	" "	Mersey, 5,000 ft.	" "	33 ft.
Antwerp	" "	Scheldt, 1,500 ft.	" "	25 ft.
Hamburg	" "	Elbe, 1,000 ft.	" "	17 ft.
Bremen	" "	Weser, 400 ft.	" "	23 ft.
Havre	" "	Seine, varies	" "	25 ft.

Not having at hand similar data regarding the ports of the United States, general considerations will be given, showing how little tide most of our ports have. The Gulf of Mexico has almost no tide and the ports thereon have no tidal problem to face. This is unfortunate in two directions, as a tide would favor the growth of rice in the Gulf States, and would tend to the sanitation of some of the estuaries and "lagoons" of the southland. However, storms hurl the sea upon the gulf shore with great force, as was instanced in the terrible storm at Galveston a few months ago, and which, were it not for the sea wall, would have devastated the city. The Pacific tides are very regular and the course is northwestward. This saves our own coast and the total tide range in San Francisco Bay is only four and three tenths feet.

As the Atlantic basin is comparatively narrow and the shore contour is very irregular, the tides are much retarded and Newfoundland and the north country get the worst of it, the Bay of Fundy having a dangerous tide of from

fifty to seventy feet. But along the New England coast the mean tide is about eight feet, while in Boston harbor it is about nine and one half feet. At New York city it is about four and one half feet and probably six feet at Philadelphia. Baltimore and Washington have about half that much and the same conditions prevail along the South Atlantic coast to Florida. The three-foot tides of Georgia and the Carolinas not only favor the growth of rice but possess a sanitary value.

This question of tides means a vast deal to us. The port of Liverpool has had expended upon it about two hundred thousand dollars per acre of enclosed basin to make of it the excellent and sanitary harbor it is. The federal government has expended comparatively small sums upon our harbors and navigable rivers. San Francisco harbor, as an illustration, is self sustaining, and no city or state taxation has been levied or used for harbor purposes. The port charges there for dockage, tolls, and wharfage average thirteen cents per ton, while the European ports average up about forty cents per ton. The same factors allow us to handle cargo about three times as fast as they do in Europe. All these things taken together allow us to pay a much larger wage and still compete with Europe upon equal or better terms.

Sewers discharging into waters having very high tides do not operate well, lands are inundated and become insanitary where the tides run very high unless the land is very high itself, sewage and detritus is cast up by a high tide, and the whole general tendency is to render difficult the sanitation of the port. There are no insurmountable difficulties, but the expense is very great indeed. Our advantages here should promote our shipping business.

Many of our inland people do not realize how indented is our sea border, the coasts upon all shores being cut into by long and very roomy harbors and bays. The accompanying roughly sketched map of New York harbor illustrates this. From Battery Park, the lower tip of the city, to the lower bay is about ten miles. The upper bay is quite a body of water, but a little shallow over toward Bayonne. Within a week I have been all over the harbor and find little there but what is to be commended. The New York City Department of Health has authority over the whole port and through its most efficient health officer of the port, Dr. Doty, is in constant and effective supervision. The quarantine station of the port is located as indicated by the circle down by the narrows, and I spent sufficient time there to see that it is practically impossible for an infected vessel to enter without detection. Dr. Doty has also practically eliminated mosquitoes from Staten Island. An interesting account of this work is given in "The Mosquito: Its Relation to Disease and Its Extermination," by Alvah H. Doty, M.D., New York State Journal of Medicine for May, 1908. He had four hundred miles of ditches dug and restored about twelve square miles of land to agriculture, as well as destroying the breeding places of the insects. This was done under municipal control, otherwise it were but partly possible. Dr. Doty does not believe that the mere treatment of breeding places along the seashore is at all effective in the permanent destruction of the *Culex sollicitans*, the salt water mosquito so famous in Jersey.

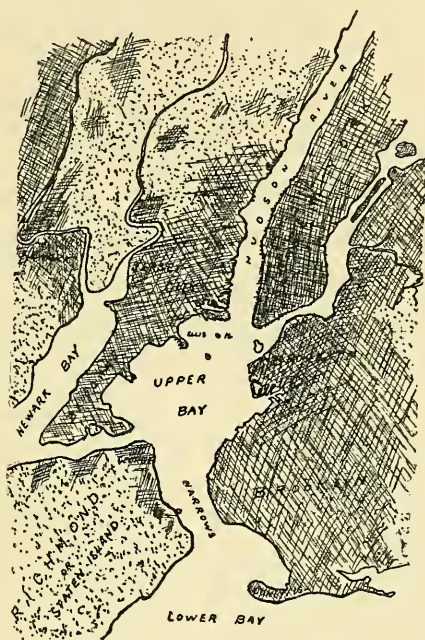


PACIFIC STEAMSHIP, MINNESOTA
PRIVATE BATHROOM, MINNESOTA



STATE ROOM, SHOWING FORCED
VENTILATION
A GENERAL TOILET AND BATHROOM

Pier 1 at "The Battery" is the headquarters for the regulation of the docks and harbor, the harbor police and the dock officers being an alert body of men and co-operating with the health department. Instead of depending upon "Regulations" wholly, this port is run by *orders* and the result is probably the most sanitary port in the Union.



As much cannot be said for Newark Bay, figured upon the sketch. It is the "back alley" of New York harbor, and the far from ideal Passaic River runs into it, carrying the sewage of Patterson and numerous factories. It reminds me of the Schuylkill River of Philadelphia. It is also a filthy "back alley" for shipping. The Pennsylvania Department of Health, ordered innumerable nuisances and sources of contamination removed. That was a year or more ago, but I found it the same open sewer of old when I looked it over recently. Probably very low water was partly responsible for conditions. The truth is that these small rivers lined with factories and accommodating a local shipping are bad nearly everywhere and are very hard to keep clean. Milwaukee, Chicago, and many other places have almost vainly wrestled with this problem, but some day it will be solved. Aside from this, the Port of Philadelphia is in good sanitary condition. I have recently "done" the Delaware River from Trenton to Chester and note numerous improvements. However, people living upon the New Jersey side claim that more sewage enters the river than was the case a few years ago.

Baltimore will have a sanitary harbor in time, but it is at present admittedly bad. "The Basin," as it is called, receives a large amount of sewage,

and as it is practically a dead end from the Patapsco River, there is very little current, except what is produced by the slight tide normal to the place. I find the city hard at work constructing an excellent system of sewers and a sewage disposal plant, and there is no reason why the harbor may not become quite sanitary.

Washington is rather fortunate with its harbor, and the sanitary administration of the city is such as to bring about very good conditions. While there is tidewater to Washington, the Potomac River aids very materially in producing a current that keeps the stream and harbor in a good sanitary condition. Outside of the navy and river boats, there is not much shipping coming into the harbor. However, there is a good stage of water, the boat upon which I went up from Norfolk being capable of accommodating twenty-five hundred passengers for the day trip.

Norfolk, Old Point Comfort, Newport News, Portsmouth, and adjacent places in the Hampton Roads district have splendid harbor facilities, deep water extending right up to the shore in many places. The gulf harbors I have never seen, but judging from literature and the active quarantine regulations, they must be maintained in a good sanitary condition.

San Francisco has a remarkable harbor, the bay covering two hundred and fifty square miles and having a minimum depth of nine fathoms. The Golden Gate is a mile in width, and up to three hundred and sixty feet deep. The harbor does a large business and is very well managed. The principal sanitary problem has been the destruction of rats infected with the bubonic plague, as referred to under California in the chapter upon "State Boards of Health."



Even more remarkable is the great arm of the sea constituting a series of harbors, upon the shores of which are the thriving cities of Vancouver, Bellingham, Victoria, Seattle, Tacoma, and other growing places. This region is a great center of industry in the wonderful Northwest. The map is a portion of one in a folder of the Northern Pacific Railway.

Boston, Newport, Providence, New Haven, Charleston, Savannah, Jacksonville, Tampa, Pensacola, Mobile, New Orleans, Galveston, San Diego, Astoria, and many other places have harbors quite worthy of description, while fine river harbors, such as those of Albany, Pittsburg, Richmond,

the Mississippi River cities, Cincinnati, and others, are worthy of improvement upon the part of the government, and are destined to play an important part in our commerce.

Most Eastern people are apt to forget that out in Minnesota the Mississippi River is navigable to Minneapolis and St. Paul, and that Duluth has a good harbor upon Lake Superior. Green Bay points and Milwaukee do quite a lake trade, and the various railroad docks and the Chicago River at



SAN FRANCISCO HARBOR

From a map in the Biennial Report of the Board of State Harbor Commissioners of the state of California.

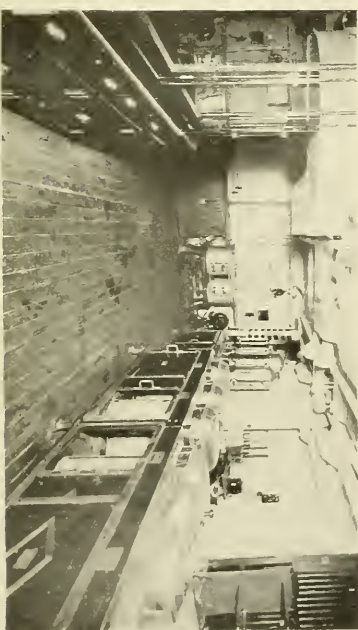
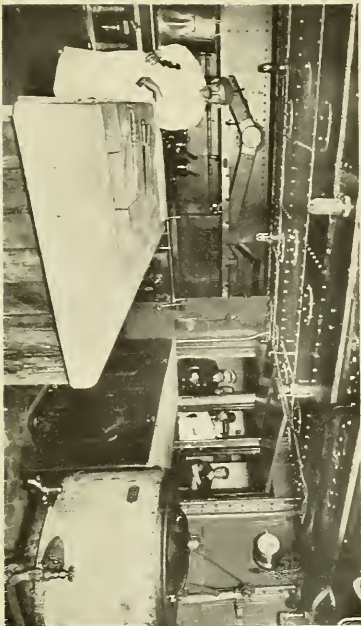
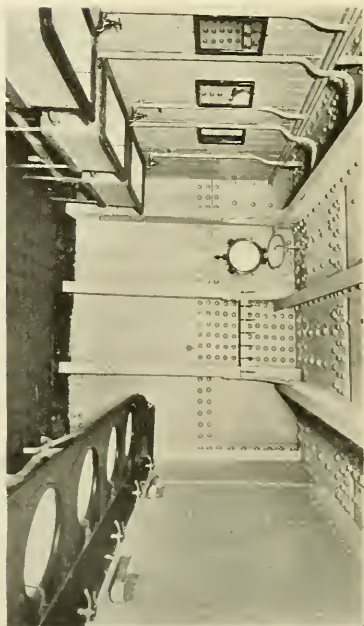
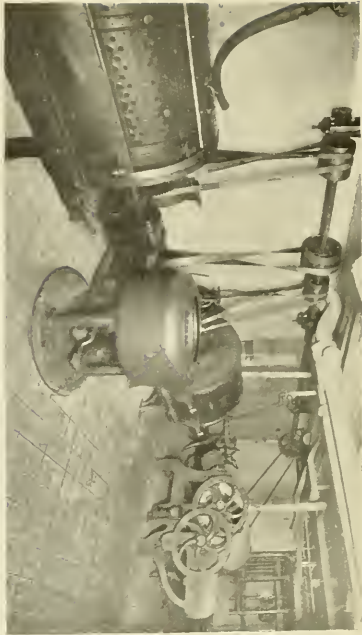
Chicago handle quite a large business. Sanitation has occupied much attention at these points, but Chicago especially is growing so fast that the engineering journals are at present discussing the inadequacy of the Chicago drainage canal to dispose of the sewage in the outlying districts. It is a big problem. Chicago is doing the best she can but the problem of sanitation in its waterways is hard to fully solve. The question is too big a one to take up here. The Illinois State Board of Health lays considerable stress upon the septic tank method of sewage disposal, as enlarged upon for municipal purposes, and it is probable Chicago will improve upon the present far from ideal methods of sewage treatment. Detroit has a splendid water front; one of the finest I have seen and the water is so deep and the current so rapid that there is very little of a sanitary problem to solve as regards its harbor. Cleveland has an artificially made harbor that serves the purpose fairly well,

but the small river emptying into it is a dirty stream, and does not improve the appearance of the harbor. The surroundings are fair, but the city has an excellent health administration, and the several times I have been there lead me to think that Cleveland is taking good care of the sanitation of its harbor. Erie has a fine natural harbor, much improved by man, while Buffalo has constructed extended breakwater basins and has a very good harbor. The tonnage of the vessels upon the great lakes is greater than is that of the English navy. In general, the lake harbors are quite sanitary, but considerable sewage is discharged into the lakes and the water is somewhat polluted. From my observation, this contamination is being reduced. The piers built away out into the water, like the government pier at Chicago, have no especial sanitary problems to face, but those upon the small rivers connecting with the lake harbors are in need of more careful supervision.

Taking United States harbors generally, they are as clean as are the rivers that empty into them. The harbors themselves are well supervised, but when one takes a launch and makes a trip about the inlets and streams adjacent, he finds much that is open to criticism. In looking over the reports of harbor officials and the rules and regulations of the large harbors, I do not find much mention of sanitation. There is a tendency to shift all of that to the health officers of the ports. In my humble judgment, this matter could be improved upon. There are rules nearly everywhere prohibiting the dumping of refuse into harbor waters or permitting refuse to accumulate upon piers and docks; but when vessels by the score are tied up in a harbor and large and ignorant crews are aboard of them, it is very hard to enforce such regulations, especially after night. From what I have seen, I believe every large harbor should have a municipal garbage boat to make free collections of garbage from all vessels in port.

Mosquitoes and rats should be suppressed about all harbors. Only an hour ago I read of a death from bubonic plague at San Francisco, due to an infected squirrel. Yellow fever and bubonic plague are too serious propositions to leave to chance. They *may* occur at New York city. When we recall what was said in the opening paragraphs of this section, it is readily understood that America is in position to spend large sums upon the sanitation of her harbors, and not be pressed for money in doing so. There should be a systematic warfare upon rats and mosquitoes at all ports.

Another thing should be stopped and that is allowing vessels to pump bilge water and leakage into harbors just as suits their convenience. Much of this water is filthy beyond expression or contaminated by all sorts of cargo. If sewage is discharged into harbors at all, it should be strictly regulated. Some harbors are made very filthy by the leakage of oil, coal tar, and other carbonaceous materials. Spoiled fruit, dead animals, broken cocoanuts, rejected and dead fish, soiled waste from the engine rooms, broken crates, poultry feathers, ashes, rejected clothing, animal dejecta, bones, and a host of other things I have seen in our harbor waters. An effort is made to prevent this, but from what I can learn the only effective method of stopping it is to arrest and heavily fine offenders. Masters of vessels contract the erroneous idea that they are sole authority upon their vessels in harbor, just as they are at



INTERIOR VIEWS NEW STEAMSHIP "LAPLAND"

LAUNDRY ELECTRICALLY OPERATED

ONE OF THE WASHROOMS

GALLEY

KITCHEN

sea, and many of them are an ignorant and bigoted set of men, who promptly resent the interference of sanitary officials. The latter gentlemen need considerable backbone. If they do not have it, they should seek some more congenial occupation.

Construction of piers and docks.—Eastern people can get a good idea of good pier construction if they inspect the new steel piers at Atlantic City. San Francisco shows good illustrations upon the Pacific. More particularly upon the Pacific Ocean, green or untreated piles are ravaged by marine worms known as *Teredo navalis* and *Limnoria terebrans*. The piles soon become so weak as to be dangerous. Treating them with creosote makes their life about twelve years. Steel cylinders and various combinations of steel and concrete are displacing wood. Probably the most durable pile is made by sinking a steel cylinder to a firm bottom, and either pointed so as to prevent the cylinder from filling, or the contents of the cylinder removed, and the cylinder filled with concrete. Concrete filling is used in either case. Sea walls should be very firmly constructed. The common practice of dredging out a trench and filling with rock and using loose rock as an armor for a fill of earth is not satisfactory, because the tide washes out the earth behind the rock, and piers and docks built upon such a wall are liable to settle and become dangerous. Bulkhead wharves are best constructed of concrete and steel and surfaced with asphalt. Pier and wharf construction is very liable to destruction by fire, especially where there is oil upon the surface of the water. I understand that the large shippers of oils are not responsible for the greater quantity of oil, but the vessels using it for fuel are the worst offenders. Sheds for piers should be of steel and concrete, and have rolling steel shutters for all door openings. Inflammable freight should not be permitted to remain long upon the pier.

Many freight boats carry passengers and the main space inside the sheds is given up to freight and teams, while the passengers must pick their way through or follow a dirty alley to the wharf. Even prominent steamship companies often have such an arrangement. I like the plan of the "Long Pier" in Baltimore, which has an outside pavement for pedestrians.

Workmen upon wharves, docks, or piers need more supervision than they usually are subjected to and intoxicating liquors should not be allowed upon any wharf or in any office connected therewith. It has been alleged that negro stevedores in the South are supplied with cocaine by their employers so as to retain them at work. Of this I have no knowledge, but if it is true it should be suppressed.

SANITATION AND SAFETY OF PASSENGER VESSELS

Ocean travel upon a first-class vessel is more safe than is land travel upon a fast express. The Bureau of Navigation of the Department of Commerce and Labor at Washington will supply interested persons with copies of the "Navigation Laws of the United States" and with the recent act adding thereto. It is hardly necessary for us to enter into a discussion of these laws and regulations here, although some of them relate to such sanitary

matters as the cubic capacity per passenger, etc.

There are well-defined east and west steamer "lanes" upon the oceans, and sailing vessels have other courses laid out for them. This reduces danger from collision. The quadruple expansion engine and the turbine type of engine, as well as twin screws, made possible larger vessels, and it seems the larger they are the safer they are. Practically all vessels are now constructed with compartment bulkheads operated by a pneumatic mechanism, and it takes a fearful destruction of the hull to sink a ship so provided and in which the crew maintains discipline. The wireless telegraph has demonstrated its value aboard ship and particularly so as a means in procuring help in time of disaster. Rocks and shoals are indicated by lighthouses, buoys, sirens, bells, and more particularly by the submarine bell. The sound from the latter reaches the ear of the man in the wheelhouse by telephones placed below the water line. Fire and fog are still terrors of the sea, but the dangers of both are being overcome. The tube fire detector will indicate even the smoking of a cigar in the hold of the vessel. The destruction of derelicts, the life-saving stations, rockets, and other signalling devices, good lifeboats, life preservers, careful drill and discipline and elaborate government inspection all tend toward safety aboard ship. The *Cosmopolitan* for July, 1909, contains an interesting article upon this subject by John Robinson Binns.

It is hardly to the credit of America that most of our large passenger vessels are built abroad. I have a communication from The Harland & Wolff Shipbuilding Co., of Liverpool, who state, with reference to the sanitary features of shipbuilding, as follows:

Regarding sanitary quarters, we rely

1. On cleanliness.
2. An abundant supply of salt water for flushing purposes.
3. Ample ventilation natural or artificial; suction preferred so that the air is changed completely every two or three minutes. This causes a current of air to flow towards these parts of the vessel, and the fans or ventilators, being placed as high up as possible, discharge the foul air clear of passengers' and living rooms.
4. Separate ventilation of soil pipes by pipes led through ship's side.

Owing to the Oriental trade the vessels plying upon the Pacific Ocean have the greater sanitary problem to face. That ocean being wider than is the Atlantic Ocean, the voyages are longer and the difficulties are increased thereby. Consequently I have chosen a Pacific vessel to illustrate what I may have to say with reference to the sanitary conduct of an ocean liner. Mr. A. L. Craig, general passenger agent of the Great Northern Steamship Company, has supplied me with photographs of the great steamship *Minnesota*, and Mr. C. C. Lacey, marine superintendent of the line, has supplied the following description of the sanitary features of the vessel:

The sanitary system is patterned after the best hotels and public buildings. Our lavatories and baths are all mechanically ventilated and are fitted with the Watrous aquameters, Lucania and Cairo bowls, and enameled iron bath tubs.

The piping system is of the usual water trap system, and the flushing of the mains is under a pressure of forty pounds per square inch. Sea water is used for all flushing purposes. The lavatories and bathrooms are steel lined, and the floors laid with

cement and vitrefied tiling, which insures against absorption of moisture from leakage of pipes or decks. During the five years of service we have had but few complaints of any obnoxious odors.

The Chinese crew's quarters are arranged with lavatory tanks which are of the continuous flushing system, and are always free from overflow, and have always worked satisfactorily.

For the medical and sanitary care of our passengers, will say that we have had but two cases of malignant diseases. With the ordinary cases of sickness our passengers remain in their quarters. The staterooms are perfectly ventilated, both natural and mechanical. If the sickness is of a contagious nature we use the hospital in the after-part of the ship and on the main deck. The most of our sickness is among the Chinese passengers and crew.

We carry one surgeon who is supplied with the necessary drugs and tools for most any kind of work in the medical line.

The vessel is 630 feet long, $73\frac{1}{2}$ feet in beam, and 56 feet deep from the keel to saloon deck amidships. Add to this the various decks and the height to the upper navigation bridge is 88 feet 4 inches. The total dead-weight capacity is 23,000 long tons in addition to the weight of the stores and equipment, while the vessel has a cubical capacity of 28,000 tons of 40 cubic feet, available for the stowage of light cargo.

The vessel accommodates 318 cabin passengers, 1,500 troops or Asiatic steerage, and a crew of 250.

The fittings include bilge keels, double bottoms, twenty-six watertight compartments, water and sulphur fumes, fire-extinguishing apparatus, all the usual safety appliances, suites de luxe (not illustrated) and finished in mahogany, and with elaborate fittings, elaborate staterooms with running water, telephone, electric heating and lighting, mechanical ventilation, and every luxury; the dining saloon, music room, library, smoking room, nursery, and other public quarters are finished with little regard to expense; food inspection, laundering, and the sanitary quarters are under expert care. It stands to reason that the cabin accommodations of such a vessel would be sanitary, but what are equivalent to what is commonly called "steerage" is called "third cabin" on this vessel, and the third-class passengers have staterooms on the main deck forward. These quarters are good, although there are three to five berths in each stateroom, and they are separate from the Asiatic steerage. This latter does not depend upon hatches for ventilation, carries Japanese and Chinese cooks, and is obliged to supply an opium den.

The vessels of this line follow the Japan current and require about fifteen days to sail from Seattle to Yokohama and then proceed to Kobe, Nagasaki, Shanghai, and Hong Kong. A round trip to Hong Kong takes about seventy days, allowing about a month ashore at various ports of call.

In looking over the crack steamships coming into New York harbor, one cannot but be impressed with the sumptuous and sanitary quarters for first and second cabin passengers, but some of the older of these same vessels have wretched steerage accommodations, with open berth sections, and not nearly so good as those upon the Minnesota, already described. However, the bad features of "steerage" quarters are in process of elimination by

business competition. It is easy to assail the so-called "trust," but it is the "International Mercantile Marine Co.," known as "the steamship trust," that is improving "steerage" quarters. They are the people who had the merry rate war with the Cunard Steamship Co., and control the White Star Line, International Navigation Co. (American and Red Star Lines), Leyland Line, Atlantic Transport Co., Dominion Line, and National Line. They also have traffic agreements with other lines.

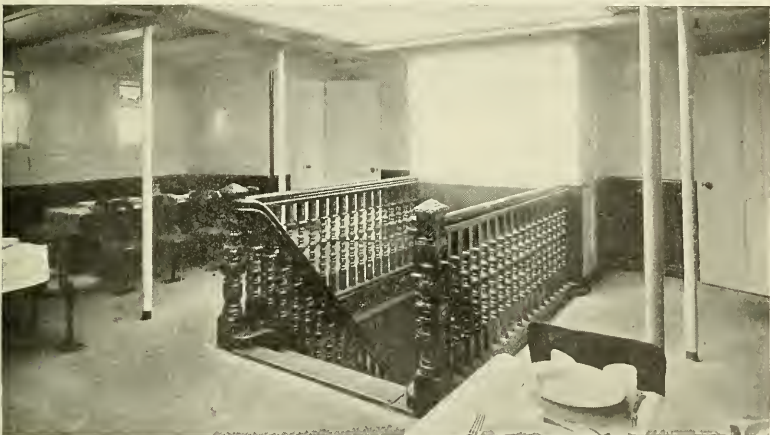
I spent some time at their offices at 9 Broadway, and was shown many things of interest, but what impressed me most was that the sanitary problem is appreciated by a trust (as I have found in other directions), and their very latest 1909 vessel, the S.S. Lapland, has modern quarters for steerage passengers. Two illustrations of this vessel are given; the galley and the washroom construction for the steerage passengers. This vessel carries 400 each of first and second cabin passengers, and 1,800 third cabin or steerage. It is of 18,694 gross tonnage, is 620 feet long, 70 feet beam, and 50 feet deep. It is a model of sanitation.

But the most interesting thing of all is the "Gothland." This Red Star liner is the "Gothic" of the Australian and New Zealand service, but rebuilt and renamed. She is a very good ship, of 7,736 tons gross, 504 feet long, 53 3-10 beam, and 37 deep. The vessel accommodates a total of 2,100 passengers, *all third class*, and sails between New York and Antwerp at a rate of at least sixteen miles an hour. The accompanying photographs show how well the vessel is equipped.

All of the decks usually accorded to passengers are available to these "steerage" passengers, and they have perfectly sanitary and comfortable quarters. This is a step in the right direction, and it is to be hoped that other lines will be forced to follow the example. In this boat, married couples have entire privacy, while other staterooms are of a size for a family.

There are many problems involved in the sanitation of ships that are discussed in the chapter upon "Army and Navy Hygiene," and it is suggested that the reader consult that chapter for further details.

A few words must be said about marine freights. In the days of leaky old wooden sailing vessels, there was much insanitary freight. But nearly all long voyages are now made under steam. In temperate and in northern waters there is very little cause for complaint, but in the tropics some merchandise becomes most insanitary. This is particularly true of hides and bones from Argentina. Some of the vessels so loaded become swarming with maggots and the decks must be constantly washed free of them. Our southern ports must keep a constant lookout for insanitary cargoes. We Americans are charged with packing our goods very poorly. That does not do aboard ship. Doubtless there are still many insanitary cargoes and poor quarters for crews of freighters, but conditions are improving as construction is advancing. I have heard many people tell of the awful conditions "before the mast," but they get their ideas from fiction. I have been aboard many freighters and "tramp steamers," and have seen some conditions far from ideal, but they are not half so bad as the novelists would have us believe.



INTERIOR VIEWS IMMIGRANT STEAMSHIP "GOTHLAND"
DINING-ROOM — STAIRWAY — SMOKING-ROOM

Section No. VI

INSPECTION OF IMMIGRANTS — CARRIAGE OF ANIMALS FROM INFECTED PORTS AND SECTIONS

THE great question of immigration and naturalization, for one should follow the other and make the question but *one*, has involved the thought and labor of some of the brightest men of our times. The loosely conceived notion that the federal government very lightly regards the matter is erroneous, and the well-meant efforts of newspaper and magazine writers to arouse the public to the realization of alien dangers that confront us, but suggest questions that have long received the earnest thought of the authorities. Persons who would like more extended information upon the matter than can be given here will do well to read the Annual Report of the Secretary of Commerce and Labor from year to year. The one for 1908 contains some thoughts of great interest. Permit me to quote therefrom:

The facility and cheapness of communication, especially in ocean travel, during the last two decades, which has contributed so materially to immigration to this country, has, as the figures I have referred to indicate, likewise contributed to emigration from this country to other lands. It has influenced also, in a much lesser degree, the migration from this country of native-born citizens.

There are some who regard this large emigration of aliens and naturalized citizens as an additional objection to immigration in general, inasmuch as many of this class who come to this country, and by industry and economy accumulate what will give them, in the country of their origin, a reasonable competency, return thereto, either for temporary sojourn or to spend their remaining years.

This subject has other important aspects which should not be lost sight of. Notwithstanding the large increase in immigration during the past decade, the wage standard of this country has not been lessened; on the contrary it has continued to increase. The immigrants have also in more recent years contributed quite materially toward transplanting new industries from the different countries from which they emigrated, and toward expanding, among other industries, those that had already been transplanted and established. I think it can also be stated as a fact that the immigrant laborer as a class usually finds employment at the bottom of the scale of industries, thereby leaving the higher grades, where work is more remunerative, to the native workman.

In a commercial sense, this emigration is not without significance. The immigrant who comes to this country, lives here for a number of years, and returns either to his own country or to some other naturally takes with him, not only the money that he has through thrift and industry accumulated, but also, to a greater or less extent, American ideals, American tastes, and American requirements. These he consciously or unconsciously transplants. The influence of this emigration upon our foreign trade, especially upon our exports, is not inappreciable. The emigrant is a commercial missionary. His desire for many of our manufactures, with the need of which he has become accustomed, has doubtless, to some extent, contributed to the export of such products, both directly and indirectly, to the country to which he has emigrated.

There is still a larger view which may properly be taken, and should not be disregarded. This migration, when normal and not induced by oppression or persecution, has a far-reaching influence in interpreting one nation to another, in establishing

closer relations, and in promoting the peace of the world. Charles Sumner, in his "Prophetic Voices Concerning America," no doubt had this phase of the subject in view, together with other causes, when he stated that "the national example will be more puissant than army and navy for the conquest of the world."

A thoughtful reading of this quotation will answer most of the arguments advanced against our commingling with aliens. And when we find that this department of government activity is one of the most potent agents in the suppression of the white slave trade, the debasement of labor attempted by heartless contractors for foreign labor, the attempt to force oriental labor standards upon our Pacific coast, the shipping of the morally and physically unfit to our shores, and other things threatening our country, we will come to know that the government is very much awake to the interests that good citizens hold most dear.

The inquirer should then read the Annual Report of the Commissioner-General of Immigration from year to year. From the last reports received, a few data will be selected. The matter at large hardly concerns the scope of the present volume.

There are four lines of work, viz., the bureau proper, the Chinese division, the division of information, and the division of naturalization. There is a working agreement with the steamship companies whereby the deported aliens are well provided for, and the laws require that every person entering have a sufficient amount of money for present purposes, and an average of about twenty-three dollars is brought in by each immigrant. About 1.3 per cent of the total number applying for admission are turned back; in 1908 there being 370 rejected for mental and nervous diseases, 3,740 for pauperism, 2,900 for contagious diseases, 53 for tuberculosis, 136 for criminality, 124 for prostitution, and other moral causes, 43 for importing prostitutes, and 1,932 for coming as contract laborers.

The department is making every effort to place these aliens in such locations and occupations as will be of greatest economic value to the country and of greatest aid to the aliens themselves. The exploitation of possible or probable immigrants by steamship companies and European money lenders are abuses now largely in check. As a single illustration of the abuses investigated by the department, the following quotation from the 1908 report will serve to indicate the conditions met by the officials and being largely corrected by them.

One of the Bureau's inspectors, Mr. A. A. Seraphic, thoroughly versed in the Greek language and in the customs and business methods of Greece, has devoted considerable time during the past year to investigating the Greek shoe-shining establishments of several of the large cities, and has submitted an able and extremely interesting report, which would be quoted but for lack of sufficient space. He prefaces his report with a description of the conditions under which young Greek boys are apprenticed or bound out in Greece and Turkey at wages ranging from \$10 to \$20 per year, finding employment with roving bootblack bosses, peddlers, café and restaurant proprietors, and keepers of combination groceries and saloons, also showing that the hours of labor are extremely long, extending often from six A.M. to twelve P.M., and

that the food furnished the apprentices is barely sufficient to keep body and soul together. This he assigns as the principal explanation of the willingness of Greek boys to come to the United States under the padrone system, and to be held in practical slavery by the padrones for terms of years under conditions with respect to pay, hours of labor, and living accommodations which are abominable, according to the standards of this country, but are considerably better than those existing in their native land. The Greek padrones have practically monopolized the business of bootblacking in the United States, which is explained by the fact that they obtain their labor under conditions which preclude competition by persons of other races. The proprietor of a stand is able to derive an income of \$300 to \$500 a year from the labor of each boy imported. The wages paid the boys range from a minimum of \$80 to a maximum of \$250, the average being about \$150 per year. The boys are required to turn over to the padrones all tips collected by them, and such collections amount to from forty cents to two dollars per day, according to locality. The padrones keep the boys closely confined to their places of occupation and allow them to come in contact with outsiders only so far as necessary, the object being to prevent their learning of labor conditions in this country, or becoming acquainted with the English language, so that they can continue to practice imposition upon them. As a rule the places in which the boys live are highly insanitary. These insanitary conditions, especially in the sleeping quarters, close confinement to work in places generally overheated and badly ventilated, the stooping position which they must constantly assume, and the improper nourishment as a rule received, all combine to injure the constitution of the boys and render them anæmic, debilitated, and subject to pulmonary troubles.

Inspector Seraphic further shows that as a rule the importation of Greek boys is so arranged as to make it extremely difficult, if not impossible, to secure evidence upon which either to deport the boys or to prosecute the importers. The plan principally followed is that of claiming fictitious relationships, and of so coaching the boys as to prevent their being broken down on examination. Notwithstanding this handicap, however, up to the time of submitting his report, April 7, 1908, the inspector had been able to place in the hands of United States attorneys evidence on which two padrones of Boston were obliged to plead guilty, while in Chicago fourteen were indicted, six of whom pleaded guilty, two were tried and found guilty, and proceedings against the remaining six are still pending.

Hon. William Williams, commissioner of immigration at the port of New York, very kindly afforded me every opportunity to personally investigate the work at Ellis Island, and Dr. Geo. W. Stoner of the staff of Marine Hospital surgeons, detailed to the work of the medical division, gave me practical illustrations of the inspection and hospital work.

Since about seventy-five per cent of the total number of immigrants arrive at this station, it is thoroughly typical of the work in general, except as it may be found along the Canadian and Mexican borders. One cannot but be impressed with the humane way in which these strangers to our shores are handled, and I noted great consideration from the commissioner down to the police. I have had frequent opportunity to meet the surgeons of the United States Public Health and Marine Hospital Service, and found them at Ellis Island, as elsewhere, physicians and gentlemen of ability and high attainment. At Ellis Island they seem to me to largely cultivate their powers of observation and to instantly recognize the clinical picture presented by the

immigrant before them. The photographs I took there tell their own tale, but the following narration gives an idea of the details of inspection.

I first visited the state quarantine station at Staten Island, and found that Dr. Dory and his able assistants largely eliminate contagious cases (small-pox, yellow fever, cholera, typhoid, and typhus fevers and plague), but no one is detained there except for quarantinable disease or exposure thereto. After the state officials finish their work, the vessel is boarded by the Marine Hospital medical officers, who examine the cabin passengers, and usually complete their work by the time the vessel reaches her dock. Those entitled to land are promptly released, but those certified to the immigrant inspector must go through further examination or detention, according to conditions determined by the laws and the regulations.

Sick persons aboard are examined and any aliens among them are transferred to the hospital at Ellis Island, an institution similar to any general hospital with isolation wards. As a matter of fact, the hospital is not large, and excess cases or severe ones may be assigned to a contract hospital, while contagious cases may be sent to one of the special hospitals conducted by the New York City Department of Health and described in the section devoted to that work in the chapter upon "Local Boards of Health."

All steerage passengers are transferred by means of barges to the immigration depot at Ellis Island. The initial medical examination there conducted is short, but the doctor at the head of the line places a chalk mark upon the suspected parties' clothing, and the doctor at the end of the line supplements this examination by everting the eyelids in the search for trachoma and such other examination as may seem justified in separating the fit from the unfit. These latter are turned aside from the line and sent to special examining rooms. Those who pass are sent to the registry room or before the boards of special inquiry.

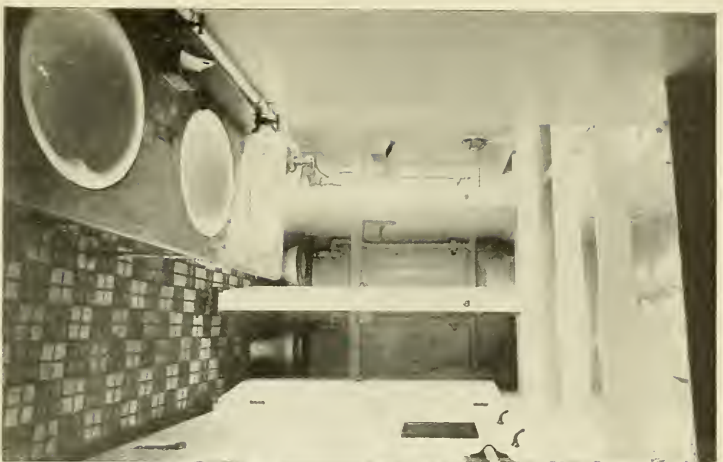
The following extract from the book of instructions, issued by the surgeon general, shows the classes examined:

For the purpose of carrying out the provisions of the immigration law, diseased, abnormal, crippled, and deformed aliens may be regarded as divisible into two general classes. Class A: Those who are excluded from admission into the country by reason of the existence of a disease or abnormal condition of a character expressly declared by the law itself to constitute a ground for such exclusion. Class B: Those who present some disease or defect, physical or mental, which may be regarded as conclusive or contributory evidence to justify the exclusion, by the proper immigration officers, of the person in question as an alien "likely to become a public charge."

In accordance with the present law, aliens of Class A must fall within one of the four subdivisions of that class, viz.: (1) Persons suffering from dangerous contagious diseases; (2) persons suffering from loathsome diseases; (3) insane persons (also epileptics, under the law of 1903); (4) idiots.

The following final quotation is from a paper by Dr. Stoner, and read by him before the New York Academy of Medicine:

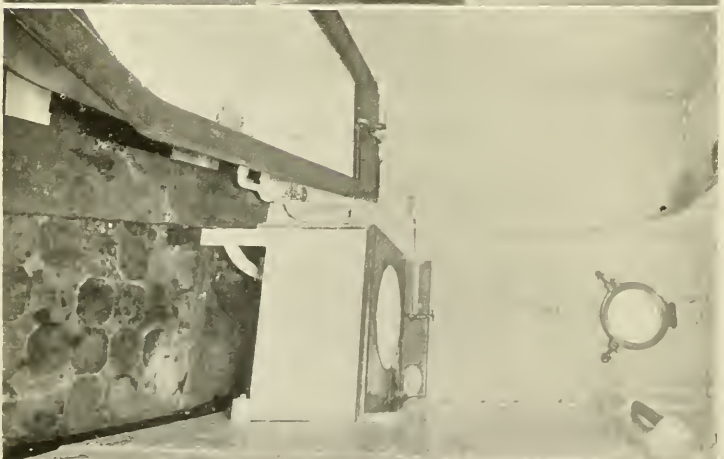
In cases certified under Class A — (1) persons suffering from dangerous contagious diseases; (2) persons suffering from loathsome diseases; (3) insane persons, also epileptics (under the law of 1903), (4) idiots — the law is mandatory. In those



WOMEN'S TOILET AND WASHROOM



INTERIOR VIEWS IMMIGRANT STEAMSHIP "GOTHLAND"
FAMILY STATE ROOM



A BATH ROOM

placed in Class B and certified for a disease or abnormal condition, "affecting ability to earn a living" (as the certificate is usually worded), the immigration officers, or boards of special inquiry, have exercised discretion; the medical certificate in some cases being regarded under the law as contributory evidence only, or, as one of several factors constituting a condition which renders an alien "likely to become a public charge." For example, of 1,231 aliens certified for senile debility, a majority was landed; certain favorable factors in or about many of these cases outweighing that of the medical certificate to such an extent that in the judgment of the board the individuals affected were not likely to become public charges.

If, on the other hand, upon special inquiry an alien is denied admission on the ground that he is likely to become a public charge, he has a right of appeal to the department, through the commissioner of immigration. Friends or relatives may offer guarantee or bond against the likelihood of the alien becoming a public charge.

It is proper to say, however, that under the regulations of the immigration service, "no application for admission under bond of a debarred alien will be considered, except in cases in which the deportation of the alien in whose behalf such application is made would involve the separation of immediate members of a family."

The present writer listened to the hearing of some of these distressing cases, and found that the law is administered in a very merciful manner.

CARRIAGE OF ANIMALS FROM INFECTED PORTS AND SECTIONS

In the Appendix at the end of this volume the infectious diseases of animals communicable to man are fairly fully discussed so far as the general practitioner of medicine would be interested. It is not our purpose here to take up matters of interest only to the veterinary profession, but some details as to what is being done to prevent the spread of these diseases is of distinct interest to all who are concerned in public hygiene.

The Department of Agriculture at Washington issues a yearly "Directory for Farmers," containing the data concerning all national organizations allied to this and kindred agricultural subjects. From the last edition I abstract the following:

Bureau of animal industry.—Chief, A. D. Melvin; assistant chief, A. M. Farington; Chief Clerk, E. B. Jones; Chief of Inspection Division, Rice P. Steddom; chief of quarantine division, Richard W. Hickman; chief of pathological division, John R. Mohler; chief of biochemic division, M. Dorset; chief of dairy division, Ed H. Webster; chief of division of zoölogy, B. H. Ransom; superintendent of experiment station, E. C. Schroeder; animal husbandman, George M. Rommel; editor, James M. Pickens.

The Bureau of Animal Industry has charge of the work of the department relating to the live stock industry. It conducts the inspection of live stock, meats, and meat food products intended for interstate or foreign commerce, under the act of Congress of June 30, 1906, and also has charge of the inspection of import and export animals, the inspection of ships for the transportation of export animals, and the quarantine stations for imported animals. It investigates the existence of communicable diseases of live stock, makes original scientific investigations as to the nature, cause, and prevention of such diseases, and takes measures for their repression and eradication, frequently in co-operation with state and territorial authorities. The bureau also

makes investigations in the breeding and feeding of animals and in regard to dairy subjects; inspects and certifies dairy products for export, and supervises the manufacture of and interstate commerce in renovated butter. Reports of scientific investigations and treatises on various subjects relating to the live-stock industry are prepared and published.

Bureau of biological survey.—Biologist and chief, C. Hart Merriam; administrative assistant and acting chief in absence of chief, H. W. Henshaw; assistant in charge of economic investigations, A. K. Fisher; assistant in charge of game preservation, T. S. Palmer; assistant in charge of geographic distribution, Vernon Bailey.

The Bureau of Biological Survey studies the geographic distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial and the destruction of injurious species. It is charged with carrying into effect the provisions of the federal law for the supervision of interstate commerce in game and the importation and protection of birds, and certain provisions of the law for the protection of game in Alaska.

PROTECTION AGAINST CONTAGION FROM FOREIGN CATTLE

An act of Congress of August 28, 1894, prohibits the importation of cattle and cattle hides, but by the act of March 2, 1895, making appropriations for the department of agriculture, it is provided that the prohibition may be suspended by the president whenever the secretary of agriculture shall certify to the president what countries or parts of countries are free from contagious or infectious diseases of domestic animals. The president, by proclamation of November 8, 1895, lifted the embargo with reference to Norway, Sweden, Holland, Great Britain, Ireland, the Channel Islands, and the countries of North, Central, and South America, so as to admit cattle under sanitary regulations prescribed by the secretary of agriculture; also from all countries so as to admit hides under regulations prescribed by the secretary of the treasury.

I am in possession of a large mass of literature from all over the United States, bearing upon live stock interests, and giving the impression to a mere doctor that more care is being devoted to breeding good cattle than to breeding a good race of men and women. At all events, we humanitarians have a world to learn from the live stock interests, and should be somewhat ashamed of ourselves that we do not scientifically undertake the improvement of the human breed upon as broad lines. From this literature I have made up the following table, showing where persons interested can secure information relative to their own state:

LIVE STOCK SANITARY OFFICERS

States having a state veterinarian usually as an officer of a board or commission.	States and Territories	Location of Office
	Alabama	Auburn
	Arizona	Phoenix
	Arkansas	Fayetteville
	California	Sacramento
	Colorado	Denver
	Hawaii	Honolulu
	Idaho	Boise

	Illinois	Chicago
	Indiana	Lafayette
	Iowa	Des Moines
	Kentucky	Louisville
	Michigan	Cass City
	Missouri	Columbia
	Montana	Helena
	Nebraska	Lincoln
	Nevada	Reno
	New York	Albany, E. Dist., N. Y. City
	North Carolina	Raleigh
	North Dakota	Devils Lake
	Ohio	Columbus
	Oklahoma	Guthrie
	Oregon	Salem
	Pennsylvania	Univ. Pa., Philadelphia
	South Carolina	Clemson College
	South Dakota	Milbank
	Texas	Dallas
	Virginia	Blacksburg
	Washington	Pullman
	Wyoming	Cheyenne
States having a live stock sanitary commission.	Arizona	Prescott (Sec'y)
	Illinois	Springfield (Sec'y)
	Kansas	Peabody (Commissioner)
	Michigan	Stanton (Pres.)
	Montana	Helena (Sec'y)
	Ohio	Columbus (Sec'y)
	Oklahoma	Guthrie (Sec'y)
	Tennessee	Gallatin (Commissioner)
	Texas	Quanah (Sec'y)
States having a live stock sanitary board.	Maryland	Baltimore (Sec'y, etc.)
	Minnesota	St. Paul (Sec'y)
		Minneapolis (Veterinarian)
	New Mexico	Las Vegas (Sec'y)
	" " (Sheep Board)	Albuquerque (Sec'y)
States having a state board stock inspect- ing commissioners.	Wisconsin	Madison (sec'y)
States having a com- missioner of domes- tic animals.	Colorado	Denver (Pres.)
States in which the state board of health in- spect animals	Connecticut	Hartford
	Delaware	Wilmington (Sec'y)
	Florida	Jacksonville (Veterinarian)
	Porto Rico	San Juan (Vet. Inspector)
	Utah	Salt Lake City
		Heber City (Sheep)

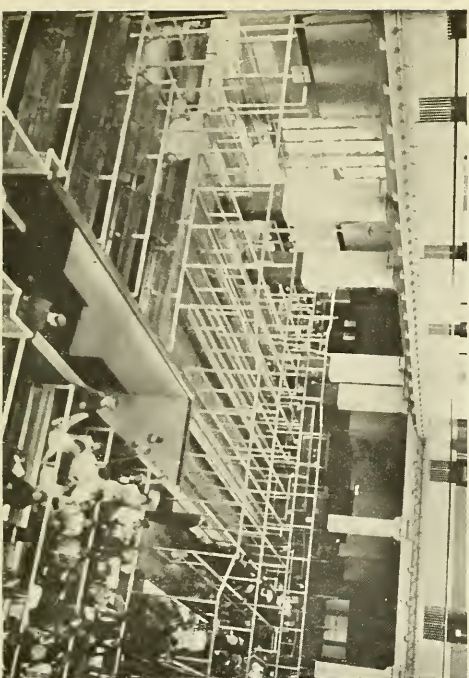
Commissioner agriculture or state board of agriculture	Georgia	Atlanta
	Massachusetts	Boston (Chief of Cattle Bureau)
	New Jersey	New Brunswick (Pres. S. Board)
	Rhode Island	Providence (Veterinarian)
	West Virginia	Charleston (Sec'y)
States placing matter under experiment stations Board of cattle com.	Kansas	Manhattan (Vet'rn)
	Louisiana	Baton Rouge (Veter'n)
	Maine	Bangor
	Mississippi	Agricultural College
Under colleges	Delaware	Delaware Co. (partly)
S. board cattle com.	New Hampshire	Concord (Sec'y)
Cattle commissioner	Vermont	Arlington

It would be quite beyond our space to give the laws of the various states upon the questions involved in these matters, but any person can procure them from the boards and other organizations noted above. As illustrative of these laws as a class, let me commend those of New Jersey, Maryland, Massachusetts, and Maine. Some of the Western states have excellent regulations. Maine probably has the best law as to interstate cattle, Pennsylvania has most practical and efficient regulations and the department is excellently handled. Vermont particularly looks after her dairies, and so it goes, every state in the Union doing something; even Nevada, which has no state board of health, looks after her cattle. Epidemics spread with such speed among cattle that these boards are highly necessary and the scientific attainments of the gentlemen engaged in the work guarantee efficient administration.

See the section upon railroad sanitation for a discussion of the details of transporting cattle.

As a matter of fact, cattle can be more effectively quarantined than is usually the outcome with the quarantine of human beings and it is easier to regulate the shipping or transportation of diseased cattle than is the case with man. Cattle go where they are driven and they do not wear clothing that conceals conditions. Also they do not have influential friends or business interests that suffer from quarantine. Therefore, when their diseases spread, it is due to the faults of law-breaking men. It is part of a physician's duty to help the authorities in limiting disease among cattle.

There is little difficulty with the transportation lines. They know what an expensive matter it is to disinfect cattle cars or ships, and they are being very careful of that class of freight. The importance to the consumers of meats and milk to conserve the health of cattle is exceedingly great, and it is only within recent years that the medical profession has come to know something of the animal menace. Incidental to this, it is being pressed home to us that unhealthy domestic pets are a positive menace. Even healthy ones may be carriers of disease. Rats carry bubonic plague, so do ground squir-



IMMIGRANT STATION AT ELLIS ISLAND

HOSPITAL AND LANDING BARGE, ELLIS ISLAND

MAIN INSPECTION HALL

IMMIGRANTS LANDING

rels. The insect menace is well known. Probably we do not yet realize all of the dangerous factors in human association with the lower animals. Permit me to suggest that physicians give these subjects more study than can be accorded to the matter in this brief review.

CHAPTER XXIV

LABORATORY METHODS IN SANITATION*

Classification of bacteria — A consideration of the principal pathogenic forms — How to recognize them — Widal reaction — Several simple methods outlined — Blood examination — Description of organisms and parasites — Types of malarial infection — Syphilis — References.

IN the preparation of this chapter, one thought has been kept in mind,— what should be said for the busy practitioner, — and no unnecessary word will be in the text. The subjects will be taken up in the following manner: first, bacteriology with definitions and descriptions of the more important disease-producing bacteria, methods of differentiation, culture growths and staining; second, the examination of the blood for certain organisms found therein, and a consideration of the data thus obtained. No attempt at original methods will be made, giving only such as have stood the test of time and authority. To this end, the works of Sternberg, Whitacre, Reeves, Woods, Beach, McFarland, Jacobi, and others have been freely used.

BACTERIA

Bacteria are unicellular, microscopic, vegetable organisms, many of which are pathogenic; many are not. We will consider only the former. They belong to the lower order of flowerless plants and consist of a nucleus, plasm, and cell wall.

Many classifications of bacteria have been made, but most of them are too complete to be of service in such a text-book as is this.

A simple, useful division is as follows:

1. Family: COCCI.

Subdivided

- (a) Streptococcus.
- (b) Staphylococcus.
- (c) Micrococcus.

2. Family: BACILLI

Subdivided

- (a) Bacterium, without flagella.
- (b) Bacillus, with flagella.

3. Family: SPIRILLAE.

Subdivided

- (a) Spirillum
- (b) Spirochæta

LIQUIFACTION OF GELATIN

As a further classification of bacteria, their power of liquifying gelatin is used. Certain of the bacteria liquify gelatin, due, it is believed, to their peptonizing power; and certain others do not. The following list, though not complete, is useful for reference:

*By Clarence R. Phillips, M.D.

LIQUIFY GELATIN

Staphylus pyognes albus
 Staphylococcus pyogenes aureus
 Bacillus tetani
 Bacillus anthracis

DO NOT LIQUIFY GELATIN

Streptococcus pyogenes
 Diplococcus gonorrhœa
 Diplococcus pneumonia
 Diplococcus intrac. meningitis
 Pneumococcus Friedlander
 Micrococcus catarrhalis
 Bacillus tuberculosis
 Bacillus influenza
 Bacillus diphtheria
 Bacillus typhosis
 Koch-Weeks
 Koch-Mallei (Glanders)

Some bacteria require oxygen, some do not, while others are indifferent. The following is an incomplete but useful list:

AËROBIC OR FACULTATIVE

Staphylococcus pyogenes albus
 Streptococcus pyogenes
 Actinomyces bovis
 Diplococcus gonorrhœa
 Diplococcus intracellularis meningitis
 Diplococcus pneumonia
 Micrococcus catarrhalis
 Pneumococcus Friedlander
 Bacillus tuberculosis
 Bacillus influenza
 Bacillus diphtheria
 Bacillus typhosis
 Bacillus Koch-Weeks
 Bacillus Anthracis
 Bacillus Mallei
 Bacillus Ducrey

ANAËROBIC

Bacillus tetani

In addition to these divisions, a classification of great value is the relation of bacteria to stains, especially as here noted:

POSITIVE TO GRAMM

Streptococcus pyogenes
 Staphylococcus pyogenes albus
 Diplococcus pneumonia
 Bacillus tuberculosis
 Bacillus diphtheria
 Bacillus tetani
 Bacillus lepra
 Bacillus anthrax

NEGATIVE TO GRAMM

Micrococcus catarrhalis
 Pneumococcus Friedlander
 Actinomyces bovis
 Spirillum Obermeieri
 Diplococcus gonorrhœa
 Diplococcus intracellularis m.
 Bacillus typhosis
 Bacillus influenza
 Bacillus Koch-Weeks
 Bacillus Mallei
 Bacillus Ducrey

We will follow this simplification of the divisions of bacteria by considering only those of importance to the general practitioner. For more complete classifications and consideration of the bacteria less frequently seen, stained and cultivated by the busy practitioner, we refer the reader to the splendid works of such men as Woods, McFarland, Reeves, etc.

Of the Cocci we will here consider only:

The diplococcus intracellularis meningitis	The diplococcus pneumonia
The gonococcus	The streptococcus pyogenes aureus and citreus

Of the bacilli we will consider only:

Anthrax	Lepre
Coli communis	Tetanus
Klebs-Löffler	Typhosis
Influenza	

Of the spirillæ we will consider only:

Spirillum Asiatic cholera	Spirochætæ relapsing fever
Spirochætæ pallida	

For the purpose of study bacteria can be grown on suitable media under aseptic conditions, and with proper degrees of heat, or they can be stained with aniline dyes.

Certain conditions favor their growth and development and certain other conditions are prejudicial thereto.

Most bacteria need oxygen for their development and such are called *aërobic*; as bacillus tuberculosis and bacillus diphtheriæ; some, however, die in the presence of free oxygen and these are called *anaërobic*; an example of these is the bacillus tetanus.

There are still others which, while preferring oxygen, can develop without it, and these are called facultative, of which the cocci of suppuration, bacillus typhosis, and spirillum of cholera are examples.

Nutrient media are essential to the growth of bacteria outside of the animal body. Of the many media which have been used (and it is well to remember that all bacteria do not grow equally well on any one medium) none is more generally useful than nutrient gelatin. Koch made nutrient gelatin as follows: One pound of finely chopped fat-free beef is placed in a glass vessel, a quart of distilled water added and the mixture is well shaken. It is then placed in a refrigerator for twenty-four hours, after which it is again well shaken and the liquid obtained is filtered through a linen cloth. To the filtrate enough distilled water is added to make a quart, and into it is placed five grammes of common salt, ten grammes of dry peptone, and one hundred grammes of best white edible gelatin. Shake well; place in a vessel in a water bath with gentle heat until gelatin is dissolved. Test for neutrality of reaction, and if necessary add sodium carbonate to produce such neutrality. The fluid is then heated for an hour in a water bath, and is tested again for neutrality. Ten minutes before the boiling is completed, the white of an egg with the shell is added, and the mixture filtered while hot.

The finished product should be perfectly transparent; if it is not so, re-boil and refilter. It is at once distributed in sterile tubes and sterilized by the intermittent method. Thus made it will keep indefinitely.

We have given space to this culture media because it is so universally useful and because the methods employed are much the same in making any of the other media as agar-agar, glycerine-agar, sugar, bouillon, etc. For the methods of preparing these media the reader is referred to any of the standard text-books on bacteriology.

In addition to the conditions favorable to the growth of bacteria there are, as has been said, conditions unfavorable to their growth. Sunlight (direct rays) and electric light in its varied forms retard the growth or kill many bacteria. High frequency currents kill by the production of ozone in the culture media.

Anthrax.—The bacillus of anthrax is aërobic, non-motile, and non-sporogenous. It is one of the easiest of the disease-producing organisms to culture, and it stains readily with the aniline dyes.

In tissues it is beautifully demonstrated by Gramm's method, while the spores are nicely stained with carbol-fuchsin, the bacilli decolorized with weak acid and counterstained with methylene blue.

A puncture culture in gelatin shows a characteristic growth along the entire track of the wire, growing especially luxuriantly where the air is most abundant. It also grows well in bouillon and on agar-agar.

Bacillus coli communis.—An aërobic, optionally anaërobic, motile, non-sporogenous (only occasionally specifically pathogenic) bacillus. It stains easily with weak, watery solutions of the anilin dyes, but not with Gramm's method.

A puncture culture in gelatin shows a nail-like growth, the head of the nail reaching often to the side of the test tube.

Bacillus Klebs-Loeffler (*Bacillus Diphtheriæ*).—About the size of the tubercle bacillus in length, but twice its width, facultative aërobic, non-liquifying, non-motile. It stains by Gramm's method, and takes any of the ordinary stains, being very easily and beautifully stained with Loeffler's alkaline blue.

It grows readily on nutrient gelatin. A swab, taken with aseptic precautions, is spread over the gelatin of at least three tubes, and these are incubated at 72 degrees F. for twelve hours.

A yellowish-white, smeary layer will be noted in the first tube, which received the greatest amount of material, a lighter layer with outlying colonies in the second tube, with the colonies predominating in the third tube, which received the least amount from the swab. From the third tube stains are to be made, and if the stain shows Klebs-Loeffler bacilli the diagnosis is made positively. Instead of the swab a platinum loop kept sterile is preferable.

Bacillus influenza.—A very small, non-motile, aërobic, non-liquifying bacillus. It stains fairly well with carbol fuchsin, but not with Gramm's method. The blood, spread thin and dried, is fixed by immersion in absolute alcohol for five minutes, incubated after staining, for three or four hours, washed in water, dried, and mounted with Canada balsam.

They do not grow on ordinary media, but upon glycerin agar twenty-four hours' incubation will show colorless, drop-like colonies, at the point of inoculation. A swab or loop culture from the throat, taken as in the case of

diphtheria and stained with carbol fuchsin, will enable a diagnosis of influenza to be made, according to McFarland.

Bacillus lepræ.—The lepra bacillus is about the size and shape of the tubercle bacillus, stains by the same methods, is non-motile, and can be grown upon artificial media.

While it stains by the same methods as the tubercle bacillus and resembles said bacillus greatly, it is readily stained with a watery solution of fuchsin, to which stain the tubercle bacillus is resistant, thus making a differentiation possible. It is positive to Gram.

Bacillus tetani.—A long, slender bacillus, with a round spore-end, motile, non-aërobic, liquifying, and positive to Gram.

It stains readily with any of the aqueous anilin solutions. The easiest method of differentiation from other bacilli is based upon its resistance to heat. Cultivating on agar-agar at 170 degrees F. for an hour all other bacilli are killed. A spread from the growth will give a pure culture under the ordinary conditions.

Being an absolute anaërobic organism, it is difficult of growth, as all oxygen must be excluded. McFarland (page 208) gives method of anaërobic cultivation.

Bacillus typhosis (*Bacillus Eberth*).—A short, thick bacillus, with rounded ends and flagelli, non-liquifying, aërobic, and motile. It is to be distinguished from the bacillus coli communis, with which it is always found associated, and for this purpose many methods have been devised. One of the simplest, that of Rothberger, consists of growing the suspected material in a liquid media containing neutral red.

When so grown the bacillus typhosis produces no change in the wine-red color, while the colon bacillus gives a yellowish hue to the solution. As this method only differentiates when the cultures are pure colon or pure typhoid bacilli, it is not so useful as is Remy's method. Using a medium which nearly approaches the composition of a potato, he grows colonies of typhoid and colon bacilli, which show marked differences. McFarland (on pages 490 and 491) gives the composition of this medium and the complex method of its manufacture.

Colonies of typhoid bacilli grown upon gelatin plates are well defined and of light-brown color.

The bacillus is negative to Gram, but stains fairly well with the anilin dyes, such as alkaline methylene blue.

Because of the difficulty of obtaining a pure culture to stain in a case of suspected typhoid fever, the agglutination reaction of Widal will be described at this point.

This reaction is due to the clumping and loss of motility of typhoid bacilli in the presence of the blood of a typhoid patient. Certain conditions are necessary that constant results may obtain. The cultures should be standard and not too fresh; that is, they should be cultivated through a number of generations rather than a fresh culture from the spleen.

The blood is best obtained from the finger, and several drops are to be

taken and immediately diluted with nine parts of a normal salt solution in a Thoma-Zeiss pipette.

Equal portions of this 1-10 dilution and typhoid emulsion are mixed, placed in a narrow test tube containing sterile bouillon, and kept at body temperature. In the course of a few hours, agglutination and sedimentation, with loss of motility takes place. In order to observe the clumping, a spread is placed over a ground-glass slide which has been spread with vaseline around the edge of the concavity, to prevent evaporation. It is well to have a control hanging drop of a well-distributed field, and to make the result more positive a series of dilutions of 1-20, 1-40, 1-60.

The bacillus tuberculosis agglutinates under the same conditions, but the bacilli are motile and can be seen in the field, having a waving motion.

Spirillum cholerae Asiaticæ.—An aërobic and facultative, motile spirillum. Liquefies gelatin and is negative to Gram. Half as long as but much thicker than the tubercle bacillus; it has rounded ends and flagellæ. Is easily stained with fuchsin or any of the aqueous solutions of the anilin dyes. It grows rapidly upon plates or stab cultures of gelatin, liquifying the media. On plates the growths look like holes in the media; in stab cultures it causes a funnel-shaped hole in the medium used.

Spirochæta of relapsing fever (spirochæta Obermeieri).—A long, slender spiral organism, possessing flagellæ, motile, negative to Gram, but staining easily by ordinary methods. It cannot be grown upon artificial media.

Diplococcus intracellularis meningitis.—A biscuit-shaped diplococcus, resembling the gonococcus, non-motile, non-liquifying. It stains readily, according to McFarland, by taking twenty cubic centimeters of water, eight drops saturated methylene blue solution, and adding forty-five to fifty drops carbol fuchsin. Stain five minutes. Cocci are blue; all else is red.

Diplococcus pneumonia.—This biscuit-shaped diplococcus has a tendency to occur in pairs, but often it forms chains of five or six pairs, so that it has been looked upon as a streptococcus. It is non-motile, non-liquifying, and is positive to Gram.

A simple method to stain the capsules and make a permanent specimen is that of Hiss, who uses a five per cent solution of gentian violet, with heat to point of steam rising from slide, and washing with twenty per cent aqueous solution of copper sulphate crystals. Dry and mount in balsam.

The diplococcus grows well on any of the culture media except potato. The addition of a little alkali favors its growth.

Gonococcus.—This biscuit-shaped coccus occurs in pairs with the concavity of each coccus facing its mate. It is non-motile, non-liquifying, is aërobic and stains easily with weak aqueous solutions of methylene blue, but is negative to Gram. To differentiate from the pus cocci which occur in urethral discharges the fact that the gonococcus is negative to Gram is important. Stain by Gram's method and counterstain with Bismarck brown, when the gonococci will appear as brown organisms while the others will appear black.

This organism is very difficult of cultivation, but can be grown upon

gelatin containing acid urine, when the gonococci grow near the surface, the pus cocci growing deeper in the medium.

Blood examinations.— The presence of the malarial organisms can be definitely determined by a microscopic examination of the blood of the patient, taken preferably about eight hours before or after a chill.

A slide of fresh blood is prepared from a puncture of the lower lobe of the ear. A “three-side pointed” surgeon’s needle is the best for making the puncture. The skin is prepared by a simple cleansing of the surface with soap and water, this followed with plain water.

The puncture should draw several drops of blood without any squeezing of the parts and the third or fourth drop should be taken on a carefully prepared cover glass, care being taken not to touch the skin. Too much care cannot be taken to have the cover glass absolutely clean, as a perfect spread of the drop of blood will not take place otherwise.

After the spread is made it can be examined with or without staining. The best stain is possibly the Ehrlich tricolor mixture or some modification of it, and it is very simply done. After the spread is made the stain, made as stated below, is spread over the surface of the cover glass with a glass rod and after a few minutes is washed off with water.

The length of time of staining depends upon the length of time of heating and the power of taking the stain shown by the particular specimen. Dry between filter papers and mount in balsam.

To examine use one twelfth oil immersion lens and a wide open diaphragm, with a movable stage.

It is well to remember first, that all malarial organisms are to be found within the corpuscles; therefore the attention is not to be distracted by the appearance of anything in the field which is not in the corpuscular elements.

Also, it is well to remember that no field will contain a great number of organisms so that any field containing many *apparent* organisms is probably one in which there has been a partial drying up of the corpuscles with certain refractions of light resulting in consequence thereof.

Remember also that too thick a spread will make it difficult if not impossible to find the malarial organisms.

The organisms in their life history have different forms and appearances. At first they are not pigmented, later they become so. In the first stage they are mis-called hyaline, later they are called “pigmented.” They have for a time an amœboid movement, which makes them more easy of discovery. After this movement has ceased the pigmented cells are difficult to distinguish from dirt in the field.

At a late period in the cycle of their existence in the human host, some of the organisms develop flagellæ. They are arms two or three times as long as a red corpuscle, and one third as wide, and they are colorless and almost transparent. Various theories have been held as to these flagellated organisms, Mannaberg believing that they are the commencement of a stage suited for saprophytic existence outside the host. This saprophytic existence takes place in the mosquito, as has been proven by the work of Ross and others.

Different parasites produce different types of fever in the human host, as follows: "Benign quartan fever," due to the *hemamoeba malaria*, a quartan parasite with its asexual life cycle in seventy-two hours. The pigment collects in the center and segmentation takes place with the formation of a symmetrical rosette and afterwards of six to twelve spores. It does not form crescents and rarely flagellæ.

"Benign tertian fever," due to *hemamoeba vivax*, which completes its asexual life cycle in forty-eight hours. It resembles the quartan, but is more active in its amœboid movements. Segmentation is unsymmetrical and there are no crescentic bodies.

The "æstivo-autumnal," or malignant type, due to *hemomenas precox*, smaller than the benign and in the stage of multiplication disappears from the peripheral circulation, spleen, liver, bone marrow, and cerebral capillaries. They multiply by fission in the internal organs and take the crescentic form.

The examination of dried specimens requires a slightly different procedure. When it is impossible to take a microscope for bedside examination or when it is desired to send a specimen to a public or private laboratory, the following directions should be carefully observed.

The parts are prepared as given above, and the third or fourth drop of blood, as it flows from the ear, is taken carefully on a coverglass, which is then dropped upon a slide, so that the blood spreads evenly. So taken, the malarial organism will often be found alive after five or six hours.

To stain these dried specimens they are placed in a mixture of equal parts of ether and absolute alcohol, dried in the air, and stained in a one half per cent solution of eosin in a sixty per cent solution of alcohol, then washed in water, dried, and stained for a minute in a concentrated solution of methylene blue; washed again, dried, and mounted in balsam.

Filaria sanguinis hominis.—Spread is made as for any blood examination, except that it is taken after 8.30 o'clock in the evening, and must be stained at once with eosin. The organisms are from one ninetieth to one seventieth of an inch long, and in width the diameter of a red cell. It retains its motile power for days between cover glasses. The embryo of the parasite is found in blood.

Spirochætæ pallida.—This organism is to be found in the preputial smegma, and is believed to be diagnostic of syphilis. It is difficult to stain and no means for its cultivation outside the living being has been found.

Laboratory matters as relate to water supply are presented in Chapters VIII, XII, and XXII. Soil pollution is touched upon in several places. The laboratory side of pure foods and drugs and the milk supply is treated of in Chapters VIII and XXI. The chapter upon "Immunity," that upon "Disinfection" and portions of the Appendix dwell upon certain phases of laboratory work, while the index points the inquirer to many subjects of interest to the laboratory worker.

MEDICAL SOCIETIES AND SANITATION

A physician does not do his duty to his fellow citizens by merely treating their typhoid fevers, while making no effort to compel the local rulers to supply purer drinking water to the home. He knows the cause of this disease, and it is his bounden duty to actively labor for a pure water supply. Similar activity in urging measures to prevent the spread of smallpox and other contagious diseases is a recognized part of his professional work. The doctor may not escape this responsibility, because his sluggish temperament and unused conscience permit him to see with equanimity ignorant men and innocent children suffer and die. If he is mentally or physically lazy, let him select some position in the world where such inactivity and uselessness are less censurable. . . .

Sir Walter Scott wrote to a friend, in 1814, at the time Napoleon was sent to Elba, that the French emperor's fate was "an awful lesson to sovereigns that morality is not indifferent to politics as Machiavelians will assert. The present day needs some such assurance that politics must recognize the power of public morality. I know no man better able to teach morality and ethics to the politicians than the average doctor. —John B. Roberts, in "*The Doctor's Duty to the State.*"

THE first medical society of which we have any record in America, was organized in Boston in 1735,* and as early as 1737, "The Boston Weekly News-Letter" contained a long communication from "Philanthropus," addressed "To the Judicious President and Members of the Medical Society in Boston," and advocating a law regulating medical practice.

The second society was organized in New York about 1749, and in 1765 Philadelphia took the initial steps toward unifying the doctors. This latter organization merged into the American Philosophical Society. The first definite legislation of which I can find record† is that passed by Virginia in 1639, to prevent "physicians and chirurgions from charging masters exorbitant rates" for attendance upon slaves. In 1722 Virginia passed maritime quarantine regulations, following the Massachusetts law to prevent "the spread of infectious sickness."

There was a terrible mortality aboard ship in the early efforts of the Amsterdam Puritans to reach the New World. The ship bringing William Penn had thirty deaths from smallpox during the passage. The early Virginia settlements had a hard time with disease, "there being at the first but few physique helpees, or skillfull surgeons, who knew how to apply the right medicine in a new country, or to search the quality and constitucion of the patient, and his distemper, or that knew how to counsell, when to lett blood, or not, or in necessity to use a lance in that office at all."‡ In five years about half of the Virginia settlers died of disease or were killed by the Indians.

In the early history of the American Colonies, as well as of the Indians

*Phil. Med. Jour., January 27, 1900.

†Toner — "Contributions to the Annals of Medical Progress."

‡Packard — "The History of Medicine in the United States."

in contact with them, frightful epidemics terribly decimated the population. Smallpox, "plague," measles, diphtheria, or "cyanche," malarial and camp fevers, and others not defined, were "the terror that walketh by night and the destruction that wasteth at noonday" to many of our progenitors. The doctors of their time organized to fight these plagues, but as in the case of inoculation against smallpox, were fought by the ignorant element and by the clergy.

When medical schools began to form in the United States, medicine allied itself with exact science and the medical societies gradually came to see the application of the sciences to the amelioration of untoward conditions in the social fabric. The prison idea of restraint came first and asylums for the supposedly incurable insane were built. It was an advance, but the insane asylum of that day bears but little resemblance to the hospitals for the insane and the psychopathic hospitals of the present day, although many of the oldest states as yet make no provision for psychopathic wards. Asylums for the blind came next, and were followed by numerous sorts of institutions for the incurable unfortunates. Needless to say, the medical societies were foremost in promoting these institutions, although wealthy contributors got all of the public credit.

Then we followed the example of Europe in establishing hospitals for persons we *could* cure. The conditions were far from ideal and the hospitals were sort of sublimated pauper institutions and did not cater to discriminating persons for quite a good many years. Gradually they broadened out, but the whole idea was to *treat* the sick.

The idea of paying a doctor for keeping one well and fining him so long as one is sick, originated in China. Here, instead of the individual paying the doctor to keep "me and my son John" well, we have the state pay (and sometimes they do not pay), the doctor to try to protect all of the people from preventable disease. The selfish element in the medical profession did nothing to help this grand work along, as they were simply business men and did not care, except in an impersonal and academic sort of way. It cannot be said that they were opposed to the work; they were simply so engrossed in the routine and business end of medical practice that they simply gave sanitation and preventative medicine no especial thought. Good enough men in their way, they simply forgot that they were their brother's keepers. Many good Christians among them "passed by on the other side," for the simple reason that the awakening was not yet due. It is human nature to be impassive until something happens. All history testifies to that. Earnest Christian men, both North and South, favored slavery until the time came to end it; church officers owned distilleries and sometimes drank to excess until the temperance wave struck the country; corporations "had no souls," until some one concluded it was time they were getting them, and the process is now on, and a "soulless corporation" will soon be "in bad form" even with the frenzied "captains of industry."

It is even so with the medical profession. The time came for prophets to arise among the doctors and preach a new doctrine, and not only among the doctors, but among the people, too. "Like priest, like people," but even

more so; like people, like priest. Conversely, it was like doctor, like people; but the worm turned, and it is now, like people, like doctor. That is — the people get just the kind of priests and doctors they want or develop. It is “the general uplift” that has made the medical profession as well as others look to larger things. Things go in waves, and when one is due it is due, and that is all there is to it. A wave of humanitarianism hits the just and the unjust and changes the doctor and the corporation alike. No one has a copyright upon it any more than does a political party upon good or bad times.

But it must be said that medical societies were the first ones in the medical world to apprehend the new order of things and start in to awake the sleepers. In this country it has been largely through the American Medical Association that the profession has been brought to see “the signs of the times.”

I am perfectly aware that many physicians think that the American Medical Association has been overdoing the proposition and especially that the journal of the association overstates many things with reference to proprietary medicines and the political and governmental phases of medical work. Many worthy but more or less partisan medical journals have encouraged these ideas. Permit me to be personal enough to state that I am the president of a medical society, and have made a study of medical societies of the dominant school as well as of the homœopathic and eclectic sections of the profession, and am prepared to state that I find the brightest men of all schools working in their societies and upholding the work of sanitation. In all this land I can find no society going upon record in opposition to the advance work of public health. Local dissatisfaction with health officers has been expressed and often it *should be so* voiced, but the general principles are commonly accepted by all schools of medicine. An immense mass of half-cooked matter comes into the offices of medical journals and, if the profession could only see the unreasonable attitude of much of the rejected contributions and the ignorance displayed by some men who should know better, the doctor would not get excited over the writings of men who have seen but one side. It is only to be expected that the unfortunate environment of many excellent physicians who are struggling against all but impossible conditions, should sour a few of them and make them take unreasonable views. The overcrowded condition of the profession is to be deplored, and it is an awful pity that some effective effort is not being made to make conditions such that the more unfortunately placed members of the profession should have an environment tending to develop the best that is in them instead of being obliged to give the best of their thought to the routine getting of bread and butter for their families. I have been “up against it” myself, and know from hard experience what the country doctor has to face and cannot find it in my heart to agree with the well-meaning and prosperous gentlemen who so severely criticise the rank and file of the profession.

At the present time, the most effective agent for making the doctor take sane and reasonable views is the local medical society. Every doctor owes it to himself to belong to one, and he will find that some pet view “will not wash” when brought before the society, that some brother he has looked

down upon may have excellent and thoughtful views to present, that some idea of years ago has been disproved by recent investigations, that there are problems he has never met and cannot understand, that the United States is large and many men of many minds are shaping the best thought of the great profession as a whole, and that sanitary science is advancing by leaps and bounds.

Medical societies perform another function. It is to be expected that many communities will make it hard for the individual doctor to perform the functions expected of him by the board of health. They object to quarantine, vaccination, cleaning up their premises, putting in sanitary plumbing, paying taxes to filter the water, and many other things the doctor knows should be done, but that his patient may resent and dismiss him for in favor of some ignorant or grossly careless physician who systematically disobeys the regulations of the local health board. If the doctor is sustained by the medical society he has an advantage not otherwise obtainable, and the community will come to see that the doctors approve the measures they are required by law to place in force. Sometimes a local board may issue regulations not practicable for the individual community. Reasonable action by a medical society will be properly met by the authorities. On the other hand, local boards of health may be very remiss, and a medical society is a powerful lever to move them to do something. There are also a few alleged doctors who are mere time-servers and regularly break the laws regarding public sanitation and the performance of criminal operations. Every self-respecting medical society will get after evidence to bring these fellows to book.

Every local health officer who is a graduate in medicine (and all should be) will find it to his advantage to join the medical society of his county, and every member of the societies will find it advantageous to get acquainted with the health officer. The laws of some states, like those of Kentucky, give county medical societies an advisory power in the appointment of local boards of health and health officers. This impresses me as an advantageous arrangement from every possible point of view. There should be conferences between the health authorities and the medical societies and an attitude of mutual friendliness and respect maintained at all times.

President Taft, in an address before the University of Pennsylvania, shortly before his inauguration, said:

The functions of the government have widened, and now embrace in a real and substantial way the preservation of the health of all the people. The effect which imperfect drainage, bad water, impure food, ill-ventilated houses, and a failure to isolate contagion, have in killing people become more and more apparent with the study which great sanitary authorities have given to the matter and has imposed much more distinctly and unequivocally the burden upon municipal, state, and federal governments of looking after public health. The expansion of our government into the tropics, the necessity for maintaining our armies and navies there, and supporting a great force of workmen in the construction of such an enterprise as that of the Panama Canal, have greatly exalted the importance of the discoveries of the medical profession in respect to the prevention and cure of human diseases and diseases of domestic animals. The triumph which has been reached in the name of the medical

profession in the discovery of the real cause of yellow fever and malaria and the suppression of these diseases by killing or preventing the propagation of, or the infection of the mosquito, is one of the wonders of human progress. It has made the construction of the Panama Canal possible. It has rendered life in the tropics for the immigrants from the Temperate Zone consistent with health and reasonable length of life, and it has opened possibilities in the improvement of the health and strength of tropical races themselves under governmental teaching, assistance, and supervision that were unthought of two decades ago. Sanitary engineering with its proper treatment of water, making it wholesome and harmless with its removal of the filth and sewage and its conservation of what was noxious into most useful agencies, all confirm the governmental importance of the profession of medicine and the kindred technical profession of chemistry, engineering, and all branches of physical research.

The waste which is going on to-day in our forests, water, and soil supplies has been brought to the attention of the public in startling statistics by the president and the commission whose report he has transmitted to Congress, and such conservation may well be considered with conservation of human life, in the progress of governmental sanitation, hygiene, and the preventatives and cure of disease by quarantine and health regulations. We must look in the future to great development in these branches and to prominence in political power and authority of those who shall succeed in effecting a reduction in the loss of human life from preventable disease, and a saving of the national resources.

This shows the attitude of the government, and if the profession does not keep up with the government, so much the worse for the profession. Incidentally, if the government finds medical knowledge necessary to its work, it may also find *the medical man* equally essential. Let us as individuals and as societies rise to our opportunities.

APPENDIX

INFECTIOUS DISEASES OF ANIMALS COMMUNICABLE TO MAN

NO effort at originality will be made in this short paper, and for its preparation several publications have been consulted, chiefly Circular 94 of the board of health of the state of New Jersey, the May, 1908, Bulletin of the State Board of Health of Maine, and the August, 1907, Supplement to the Iowa Health Bulletin. The United States Bureau of Animal Industry will supply data to those entitled to receive the same and the Agricultural Departments of many of the states issue literature upon this subject. It is not our purpose here to enter at large into the subject.

Anthrax is a disease chiefly of cattle and sheep, and is very widely distributed. It is caused by a specific germ very readily killed. Unfortunately the *spores* are more resistant to destructive agents than are any other living organism and may live in the soil for years. Boiling and strong antiseptic solutions will kill them if the contact be sufficiently prolonged. Infection of animals results in several ways, usually from eating vegetables from infected fields or drinking infected water. Acute cases cause the death of the animal within forty-eight hours and sometimes in a few minutes. Subacute cases may run a week.

There is high fever, a small and rapid pulse, congested mucous membranes, depression, mental excitement, bloody discharges, sometimes swellings upon the body, and death following convulsions. Diagnosis is difficult, except by prompt bacteriological examination. Spontaneous recovery rarely occurs.

Curative treatment is not worth while, and it is most too dangerous to man to incise the carbuncles formed. If an animal seems to have anthrax, tether it in the field where it was attacked and keep it there, and as far as possible from all other animals. Collect discharges and infected soil and handle the animal as little as possible. It is humanitarian to shoot it and end its misery. Whenever an animal is touched, the person doing so should wash in an antiseptic solution. When the animal dies, procure a half cord of wood and drag the carcass upon a pile of the wood, pile the rest on top, pour kerosene over all, add the collected dejecta, and set on fire. The carcass may be buried six feet deep upon a bed of lime and then covered with lime, but the safest process is burning. Kerosene poured upon a carcass is supposed to diminish the danger. It is very necessary to follow up the wanderings of the animal from the moment of its illness to its death, and quarantine any other animal in contact with it, occupying the same stable, or even grazing in the same field. Always report the case to the proper authorities at once. Keep all animals out of the field or other premises where the case originated, and look out for that field, as it may infect animals years afterwards. The great danger to other animals comes from the bloody discharges or from feces stained with blood. If neither of these factors exist, the herd is not very apt to be infected, unless all of the cases come from some common source, such as an infected spring. Disinfect all stables or sheds and make a careful

search of the whole premises for any trace of bloody discharges. Sometimes a field becomes so badly infected that the only thing one can do is to plant it in forest trees. Liming a field cannot be depended upon.

In an epidemic of anthrax among animals, protective inoculation may be tried. Cattle immunize readily and with a rare case of death from the remedy. Sheep often die from the inoculation and the method is not satisfactory with horses.

Anthrax in man comes from handling sick animals, their dead bodies, hide or tallow, or in handling infected wool. All parts of infected animals should be destroyed at once, and every precaution should be observed by buyers or sorters of wool.

Anthrax in man is not so serious a disease as in animals, but produces a long and painful illness and sometimes results fatally. Every care should be observed by persons exposed to infected animals. The treatment of cases is no part of our present study. Consult the authorities upon internal medicine.

Glanders, sometimes called farcy.—By good sanitation this disease is becoming infrequent. It is a disease of horses, asses, and mules, although cats and dogs may contract it. Man contracts the infection quite readily. It is produced by the bacillus mallei, and in suspected cases the mallein test is diagnostic. It is not thought that the germ forms spores. However, the germ itself lives readily in decomposing matter, and may persist in an infected stable for four months. It is readily killed by ordinary disinfectants. They are conveyed from one animal to another in much the same way as are tubercle bacilli.

About ten per cent of the cases are of the acute type and are marked by high fever, lymphatic symptoms, difficult breathing, diarrhœa, emaciation, and death within three weeks, after a course reminding one of miliary tuberculosis in man. Chronic glanders is an insidious disease and of several types, reminding one somewhat of chronic tuberculosis in man. It seems to be largely a lymphatic disease, and may run for years. The diagnosis is difficult in many cases, and it may take the mallein test to tell. This product is analogous to tuberculin, but is not quite as free from erroneous reactions as is tuberculin.

I may be far afield, but have speculated upon the resemblances between glanders and tuberculosis, and it has made me think of smallpox and vaccination. Perhaps mallein may have an influence upon the human species, as regards tuberculosis, similar to vaccination in smallpox. Or, if it does not, possibly some other product of the bacillus mallei may have some influence.

Recovery of a horse from glanders is rare, the few cases recorded being in animals kept at a high altitude and outdoors, just as tuberculosis may be recovered from in man. Drugs seem to have but little influence.

It is best to kill the animal at once, or as soon as the proper authorities determine the nature of the case. Reporting, isolation, and disinfection are imperative. The Iowa regulations are as follows:

No person owning or having the care or custody of any animal affected with glanders or farcy, or which there is reason to believe is affected with said disease,

shall lead, drive, or permit such animal to go on or over any public grounds, uninclosed lands, street, road, public highway, lane or alley; or permit it to drink at any public water-trough, pail, or spring; or keep such diseased animal in any enclosure, in or from which such diseased animal may come in contact with or close proximity to any animal not affected with such disease.

No animal diseased with glanders or farcy shall be deemed to have any property value whatever, and no appraisal thereof will be made.

Glanders is an incurable disease, and there is no warrant for expending public money in appraising property manifestly worthless, and which can be compensated for only at "its actual value in its condition when condemned"; also to prevent the introduction of diseased animals into the state, and the inoculation of worthless ones for speculative purposes.

Further rules provide quarantine and burial or burning.

Man is not especially liable to glanders, but persons having the care of glandered horses may take the disease if not very careful. Infection in man takes place through an abraded surface, by way of a hair follicle, or through the mucous membranes. Acute cases in man are very fatal and seldom run over three weeks. The chronic cases run a course of several months. Occasionally the cases are purely local and respond to surgical treatment.

Persons owning glandered horses make a mistake in keeping them with the hope of ultimate cure. They rarely recover and are a constant source of danger, no matter how mild the case may be.

Rabies or Hydrophobia.—Dogs, cats, horses, cattle, sheep, pigs, goats, some wild animals, and man are subject to this disease. The specific germ has not been isolated, but we know that the saliva, the brain, and other tissues contain the virus. Cold, putrefaction, and common disinfectants do not destroy it, although acids, alkalies, and creolin will do so. Inoculation must be through the skin or mucous membrane. The average period of incubation is three to six weeks. It is not thought that the milk or flesh of infected animals is dangerous.

Clinically, there are two forms of the disease in dogs, the dumb and the furious. Pasteur was of the opinion that the dumb form was found when the spinal cord was most affected, and the furious form when the principal lesions were in the brain. The furious form is marked by melancholy, maniacal and paralytic stages. In dumb rabies, the latter stage predominates. Diagnosis is often difficult, but the suspected animal must be restrained and carefully watched. Prognosis is very bad.

Treatment of developed cases is useless. Preventive or protective inoculations cost more than the dog is worth. Rigidly confine an infected or suspected dog. Ninety days is the commonly accepted length of time for confinement or quarantine. When cases occur in a community, all dogs must be muzzled when at large. The time is rapidly coming when dogs will not be allowed to roam the streets at all. The common custom of keeping dogs in cities is a thoroughly bad one. In rural districts dogs have a certain economic value; but in cities, only a sentimental one and that should not weigh against public danger. If an animal bites a human being or another animal, do not kill the offender, but pen him up and await develop-

ments. Much needless worry and fear has been caused by the hasty killing of a dog not rabid at all, and that short observation would prove to be not a source of specific danger.

Rabies in man is so fully discussed in the works upon internal medicine, that we need not enter into the matter here at any length. Suffice it to say that but thirty or forty per cent of persons bitten by supposedly rabid animals contract hydrophobia. The late Dr. Leonard Pearson said:

If a person is bitten by a rabid animal or one suspected strongly by competent authorities of being rabid, he should very soon thereafter submit to protective inoculation. But as soon as the bite has been inflicted he should have the wound treated by a physician. The material used for this preventive purpose consists in rabic virus of different degrees of attenuation, made by drying spinal cords of rabbits dead of rabies for different lengths of time. Repeated injections of such cords rubbed up with bouillon are made under the skin of the abdomen, beginning with the weakest and ending with the strongest which has been only slightly weakened. The treatment extends over a period of two weeks. This method of prevention is very successful. During the years 1886 to 1895, out of 17,337 cases treated the death rate was only 0.48 per cent, while previous to that the fatalities were 16 per cent.

Influenza.—Horses are often affected with an influenza or “pink eye” clinically resembling la grippe in man. Many persons have thought the two diseases were identical, but there is no tangible evidence to prove any relationship. The bacillus of human influenza was isolated in 1902, but the specific cause of the equine disease has not been discovered.

Rinderpest or cattle plague occurs only in ruminant animals, but is a very fatal disease that has been kept out of the United States. It does not affect mankind. *Blackleg* or symptomatic anthrax is not communicable to man, but, like anthrax, the spores of the bacillus will retain their vitality for years, and infected stables and pastures are a serious matter to the farmer. *Hog cholera* is not communicable to man, but the flesh of the infected animal is dangerous. Persons who look after sick animals should not go near to well ones, since they can carry the disease very readily. The *swine plague* does not attack man. The same can be said of the *colt distemper* or *strangles*.

Tuberculosis.—This disease has been so fully discussed that little occasion exists for a detailed consideration here. Despite opinion to the contrary, most authorities regard bovine tuberculosis as transmissible to man. The probability of this view being correct is strengthened by the fact that *all* of the domestic animals are subject to it. As the bacilli persist in dark stables for months, and infected cattle may *appear* healthy for months after contracting the disease, many very serious problems are presented as regards milk and meat supply, and the diagnosis of bovine tuberculosis is an important matter. Whatever views one may entertain as to the diagnostic and therapeutic value of tuberculin as applied to man, the fact remains that it is of the greatest value in the diagnosis of bovine tuberculosis. The National Agricultural Department says:

Practically all the animals which react are affected with tuberculosis, and should be separated from the herd, not only in the interest of the public, but in the interest

of the owner of the herd. The best authorities admit, after studying many thousands of tests, that there are few, if any, mistakes made in condemning cattle which show a typical tuberculin reaction. The errors are principally in the other direction, that is some tuberculous animals are not discovered by the tuberculin test; but as the most dangerous of these may be picked out by ordinary clinical examination, this fault of tuberculin is not so serious as it at first sight appears. This being the case, it should not be necessary to force the tuberculin test upon cattle owners. They should be anxious to adopt it in their own interests and for the protection of their patrons. Tuberculin is a great boon to the farmer — one of the most beneficial scientific discoveries of modern times.

Persons wishing an excellent presentation of this subject will find it in the "Special Conference Number, Tuberculosis of Cattle; the Bulletin of the State Board of Health of Maine." The best presentation of the subject as it relates to milk supply is probably found in "Bulletin No. 41 of the Hygienic Laboratory," at Washington.

It is hardly safe to allow tuberculous animals to live, but, where the animal does not come into contact with others, a few cases may be cured by following out much the same line of hygienic living directed in the case of human beings.

Actinomycosis, or lumpy jaw, affects cattle, horses, swine, and man. It is caused by the ray fungus which often occurs upon the awns of barley, and the disease is infectious but not contagious. The disease is treated surgically with a large proportion of successes. Iodides are given internally, usually about two drachms daily.

For the treatment in man consult the text-books.

Foot and mouth disease.— This disease has recently caused large losses among cattle. It is an extremely contagious disease, and spreads rapidly and in innumerable ways. Its practical control involves so many things that one can readily apply all of the precautions ever taken in quarantine, except mosquito extermination, and be about right in the conduct of a campaign against this disease.

Man may readily contract it, through contact or by using the milk or flesh of infected animals. Boiling the food renders it safe. The disease is sometimes fatal to human beings.

Contagious pneumonia of horses and other animals is known to occur, and to be highly contagious in the case of horses. It is not commonly accepted that man may contract pneumonia from the lower animals, but a sufficient number of observers believe it possible, that it is well to be careful.

Trichinosis and the intestinal parasites, the life history of which may involve transmission from an animal to another or to man, are so fully considered in works upon internal medicine, that we can well omit the matter here. "Osler's Modern Medicine" gives full details. Southern cattle fever, garget, choking distemper, and many other infectious diseases of the lower animals need not be here considered.

SANITARY CONSTRUCTION

In the body of this book one will find references to some of the problems involved in the sanitary construction of buildings. We will here present a

more detailed discussion of the matter in so far as it applies to *new* construction.

In most of the cities the office of building supervision devolves upon one or more building inspectors who are controlled by definite city legislation covering all of the matters involved. Smaller cities are inclined to define what is known as the "fire limit," and exact building regulations therein quite in advance of those applying to the outlying residence section. Undoubtedly these regulations are doing much to improve housing conditions and promote sanitation. The general public are becoming more exacting as to environment, and it is difficult to sell suburban lots until after sewers, water service, and proper highways are provided. Quite aside from academic contention, the problem of the sanitary home is solving itself by virtue of an improved public taste, and the legislation looking to improved housing. Unfortunately, the rural districts are yet a little backward in this matter, and the general practitioner of medicine can do much to elevate public standards in this important advance.

The site of any human habitation should not be determined by the mere factor of elevation. In my home city one of the most elevated portions is the site of an old swamp, and to this day the closely built homes there are apt to have water in the cellars every spring. The dip of the land, water courses, the position of barns and stables, facilities for drainage, and many other factors should be considered. Where it is possible, the angle of exposure should be such as to give the best inside lighting possible.

Excavations should be protected by "sheet-piling" where the earth is apt to cave in or danger to adjoining property is apprehended. Washing by storm water is always a danger, and unprotected excavations are apt to channel and allow the cellar to fill with water. It takes a long time for such a cellar to dry out again and filled in ground against a wall will permit the entrance of surface water. In side-hill building a retaining wall is a sanitary necessity. Where at all possible, it should be provided with a summits gutter discharging at such an angle as to keep water away from buildings. Before preparing specifications for the depth of a cellar, be sure the floor is above the sewer level. It is not good sanitary practice to lay tile or terracotta sewer pipes in a cellar.

Cellar floors, whether made of cement or vitrified brick, are all the better if, when the excavating is done, three or four inches of "sparks" or locomotive or factory ashes or cinder is filled in and well tamped down. This makes a good base for a paving of any kind and is itself a fairly good floor. Cement floors should not be laid in places where pipes may have to be torn up for repairs, or where the cement is apt to "sweat." Vitrified brick is suitable for such locations, but cement and sand should be brushed over it to seal the interstices, and in order to permit washing or scrubbing.

Masonry or concrete foundations should be smoothly dressed so as to be readily kept clean or lime-washed. It is always well to waterproof foundation walls so as to exclude dampness and gases permeating the soil. This may be done with burlap and marine cement, or even with a heavy grade of tarred or creosoted paper. A course of building or roofing slate, laid over the foundation walls, will largely prevent moisture working up to the brick work.

Small areas between buildings should be paved to prevent water seeping down alongside the walls. It is well to run paved walks up to the walls.

House walls.—Well-burnt brick laid in cement mortar makes the best wall of moderate cost; but no plastering should be applied directly to it. All such walls should be “furred.” If the brick is hard, the wall does not need painting, and the expense of up-keep is very much reduced. A good brick makes all the cornice needed in a dwelling, if laid by an expert. Wooden cornices are not sanitary, and apt to be filled by bird nests. Metal ones (except copper) take frequent repairs and are apt to leak. Wooden walls should originate not less than eighteen inches above the surface and be built upon waterproofed foundations.

Hospitals should be of fireproof construction. The building regulations of nearly all cities require this. In the Journal of the American Medical Association, February 20, 1909, an excellent article upon hospital construction, by Meyer J. Sturm, B. S., gives all the data necessary for a physician to know. Fireproof residences can be constructed at an advance over other good construction, of about twenty per cent, and are not so far in the future as may appear. The cement makers and tile dealers will give data. The Keith Company, 1842 Hennepin Avenue, Minneapolis, will send for a dollar suitable plans for such houses. Many firms are prepared to build them.

The roof has much to do with the comfort of the inmates. Aside from fire and decay, the shingle roof is the most comfortable in summer and the safest in some ways. It radiates much less heat than does other kinds of roofing. In Europe tiling is largely used and gives satisfaction. It makes a splendid roof. Slate and metal roofing absorbs heat and, unless a garret or loft of some height is under it, the upper floors of the house are apt to become excessively heated in summer. Much discomfort and disease is caused by the peculiar dead heat so produced. The modern patent roofing materials of paper and felt are just as bad and are seldom properly laid. Asbestos roofing material, if light in color and well laid, makes an ugly but sanitary roof.

Carpentering should not be over indulged. A plain trim of hardwood and very slightly ornamented or carved, is sanitary and in good taste. Maple and birch are said to be the best wood for sanitary room finishing. Floors are of especial importance. The least permeable floor I have ever had constructed was made of selected yellow pine and filled with a dressing commonly used to finish the bar in hotels.

Inside walls are best made of patent plaster or the hollow sections of various kinds, over which a hard dressing is floated. A dull paint may be applied, and it is much more sanitary than is wall paper.

Heating, lighting, plumbing, ventilation, etc., are adequately discussed in the body of this volume. Permit me to suggest that the doctor in a small community can well afford to set a better and more sanitary style in house building. If he does do so he will be copied. The building conditions in portions of the country are wretched. In the chapter upon “Slums and Town Nuisances,” this is dwelt upon. Physicians resident in cities will do well to secure copies of the building regulations and make a study of them.

As illustrative of the attitude of the courts when private interests jeopardize public safety, the following is quoted from The Journal of the American Medical Association for March 13, 1909:

POWER OF CITY TO ORDER DESTRUCTION OF OLD BUILDING INFECTED WITH SMALLPOX GERMS

The Supreme Court of Illinois had, in the case of Sings and others vs. City of Joliet, the question of the power of the city to pass an ordinance to condemn as a nuisance a single old wooden building and to authorize and direct the destruction of the same and its contents. The ordinance stated that, whereas, the building in question for some time had been, and still was, occupied by a large number of persons, all of whom were more or less exposed to, infected by, and suffering with the dread contagious and infectious disease known as smallpox; was thoroughly impregnated with the germs of that disease, and was, by reason of its old age, state of deterioration, and otherwise, in such condition that it could not be successfully disinfected so as to wholly destroy such germs, in consequence of which it was extremely dangerous and detrimental to the health of the citizens and residents of the city, and the necessity existed for prompt action to prevent the spread of such contagious disease, therefore the building was declared to be a public nuisance and condemned to destruction as such, after the removal by the health commissioner of the city of all occupants to the pest house, or some other place temporarily to be used as a place of isolation.

The court does not accede to the contention that the city was without lawful authority to pass the ordinance and to do the acts charged under the provision of the state constitution that no person shall be deprived of property without due process of law. It points out that by statute the city council shall have power "to declare what shall be a nuisance and to abate the same"; also, to do all acts and make all regulations necessary or expedient for the promotion of health or the suppression of disease.

Nor does the court accept the argument that the city was without power to pass an ordinance which had application only to the property involved in this suit; that the power given to declare a nuisance must be exercised by an ordinance general in its character, operating uniformly on all persons and on all property of the same character within the city. It says that while the precise steps necessary to be taken by the city in declaring a thing to be a nuisance have never been pointed out by this court, it is of opinion that the city, in the exercise of its police power, if the emergency existed, as it appeared to have existed from the recitals of the ordinance, had the power to declare the existence of the nuisance by the ordinance which it passed, provided the location and condition of the building were such that the method ordained was the only one which could in reason be used that would be effective in preventing the spread of the disease. Many cases can readily be imagined in which the city must proceed in a manner exceedingly summary, both to declare and to abate a nuisance, and in such case the passage of an ordinance such as that here involved would seem to be a declaration sufficiently formal.

If the conditions recited in the ordinance existed, and if the building was so located as that persons in the city could not by the city authorities in the exercise of reasonable precaution, be excluded from the building or prevented from approaching so near thereunto as to be in danger of contagion therefrom, it would appear that the building was, in fact, a nuisance, and that it might lawfully be abated.

Neither were the owners of the property necessarily entitled, before it was actually destroyed, to have a day in court, where the question whether the property was, in fact, a nuisance might be adjudicated before the building was destroyed. If in every emer-

gency the owner of the property, the destruction of which is deemed necessary, must be given a hearing, the exercise of the police power would in many instances be so delayed that serious injury to public health and other public interests would result.

But the law in Illinois gives no binding or final effect to the decision of the city council on the question of fact of whether the building was a nuisance. On the contrary, this question remains an open one, which may be adjudicated.

To declare and abate a nuisance is within the scope of the power conferred on the city, and if the council, in the exercise of that power, destroys or expressly authorizes the destruction of property which, in fact, is not a nuisance, the municipality must be held liable for damages sustained by the owner. The city was not justified in destroying the property unless the statement of alleged facts contained in the ordinance was true, and then only if the property was so located and in such condition that the danger to public health therefore could not be obviated by the use of some reasonable measure less drastic than the absolute destruction of the property.

THE HYGIENE OF THE MAILS

The postal authorities take every precaution as to the reception of mail from infected or quarantined districts, but some parcels and letters will escape and mail clerks have frequently contracted smallpox from mail matter. It is the duty of physicians to supervise the mailing of matter from infected houses or where quarantine exists.

The following is from the Journal of the American Medical Association for March 6, 1909:

Rules governing mailing of pathologic specimens.— Few physicians are conversant with the stringent regulations of the post-office department governing the admission to the mails of cultures and specimens of diseased tissues. Inasmuch as it is frequently necessary to transmit pathologic specimens to laboratories for test, and especially because speedy transmission is essential, the text of the postal rules on this subject is printed in full below. Special attention is directed to the exactitude of the requirements for packing. It should be noted that the postal service will handle cultures of specimens only when destined to United States, state, or municipal laboratories. Specimens intended for medical laboratories other than public institutions must be transmitted by messenger or express.

SECTION 495, POSTAL LAWS AND REGULATIONS

DISEASED TISSUES — WHEN MAILABLE

1. Specimens of diseased tissues may be admitted to the mail for transmission to United States, state or municipal laboratories, only when inclosed in mailing packages constructed in accordance with this regulation.

2. Liquid cultures, or cultures of micro-organisms in media that are fluid at the ordinary temperature (below 45 degrees C. or 113 degrees F.) are unmailable. Such specimens may be sent in media that remain solid at ordinary temperatures.

INDORSEMENT ON PACKAGES

3. On the outside of every package of diseased tissues admitted to the mails shall be written or printed the words "Specimen for Bacteriologic Examination. This package to be treated as letter mail." No package containing diseased tissues shall be delivered to any representative of any of said laboratories until a permit

shall have first been issued by the postmaster general, certifying that said institution has been found to be entitled, in accordance with the requirements of this regulation, to receive such specimens.

MANNER OF PREPARATION FOR MAILING

4. Packages used for conveying through the mails pathologic specimens for bacteriologic examination for diagnosis in cases of suspected diphtheria, tuberculosis, and other communicable diseases, shall be constructed and prepared as follows:

MOIST SPECIMENS. VIAL OR TUBE

(a) The receptacle for moist specimens of diseased tissues shall be a strong glass vial or test tube having a capacity not greater than two drams. The vial shall be covered and made water tight by the use of a metal screw cap and a rubber or felt washer which has been immersed in melted paraffin, or, if a test tube be used, it shall be covered with a tightly fitting rubber cap.

INNER BOX

(b) The vial or test tube shall be placed inverted in a circular tin box, which shall be made of I. C. bright tin plate, and have flush or countersunk bottom and soldered joints and not be smaller than one and one eighth inches in diameter and three inches long, nor larger than two and one quarter inches in diameter and five and one half inches long. This box shall be closed by a metal screw cover and a rubber or felt washer, or tightly fitting metal-sliding cover, and shall be so packed with absorbent cotton, closely laid, that the glass or test tube contained therein shall be evenly surrounded on all sides by cotton.

OUTER TIN OR WOODEN BOX

(c) The tin box shall be placed inverted inside of a larger tin box similar to the one already described, which should snugly receive the specimen box. On the inside of the sides and bottom of this outer box there shall be a lining of compressed paper not less than three sixteenths of an inch in thickness. The outer tin box shall be closed by a metal screw cap and a rubber or felt washer. This outside box may also consist of hard wood, in the form of a block with a cylindrical hole bored in one end and extending to within not less than one inch of the opposite end; the open end to be closed with a wooden or metal screw cap with a rubber or felt washer. Or the outside box may be a cylindrical wooden box having a screw cap and washer. The thickness of the sustaining part of the wooden tube must be not less than one quarter of an inch and be lined same as the tin box

DRY SPECIMENS. TEST TUBE

(d) The receptacle for dry specimens of diseased tissues shall be a glass test tube, three inches in length and one half inch in diameter. This test tube shall be enclosed in a circular tin box similar to those already described, but measuring two and one quarter inches in diameter, and five and one half inches in length, and be lined on its sides and bottom with compressed paper not less than one quarter of an inch in thickness. The test tube shall be closely packed in cotton, and the box shall be closed by a metal screw cap and a rubber or felt washer.

PROTOZOA, ETC.

Reference has been so frequently made in this book to mosquitoes, hookworm diseases, etc., that it is well to figure some protozoa not commonly

illustrated in works upon practice. No effort is made to fully cover the subject, but a few illustrations of organisms referred to in the text I have drawn with pen and ink.

The best general presentation of diseases caused by protozoa and parasites of which I know is in the first volume of Osler's "Modern Medicine." The Hygienic Laboratory Bulletins and those of the Yellow Fever Institute and issued by the Public Health and Marine Hospital Service give much information upon the subject.

No attempt whatever is made to cover the subject at large in this present volume, and only such important data is given as is not available in the average physician's office.

As probably appropriate to this section, an article is quoted from the "Druggist's Circular," upon the common bedbug and giving much useful information concerning this common carrier of disease.

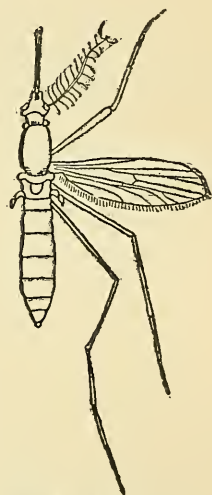
STEGOMIA CALOPUS

This is a rather handsome insect, being a study in black and white.

This mosquito will breed in filth, but prefers collections of water in and about habitations. Ordinarily, they do not breed in street puddles. The eggs are laid upon the surface of the water and resist untoward influence. The larva is readily killed by oil upon the water.

The mosquito is killed by freezing temperature and is not inclined to bite during ordinarily cool weather.

It is proven beyond any doubt that this mosquito disseminates yellow fever.



STEGOMIA CALOPUS
BIOG. YELLOW FEVER MOSQUITO
FROM YELLOW FEVER INSTITUTE BULLETIN
NO. 16.

CULEX SOLLICITANS

This is the salt water mosquito described in Chapter VI, under Parks.

It is not a malaria carrier and the coal-oil method of extermination is not effective with it.

In addition to what Dr. Doty says of it in his elaborate investigations, it is asserted to fly for long distances inland.

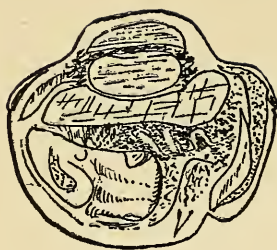
Malaria-carrying mosquitoes are so common that they are not illustrated here.



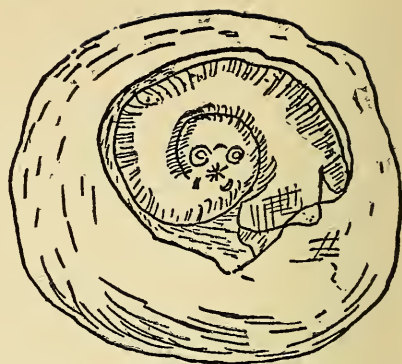
CULEX SOLLICITANS
COLLECTED FROM A SMALL POND BY NEWARD

CYSTICERCI

Hygienic Laboratory Bulletin No. 25 gives some startling data relative to "Cestode Parasites of Man," inclusive of the various forms of tape worm in the human species.



CYSTICERCUS IN THE EYE
AFTER VON WECKER



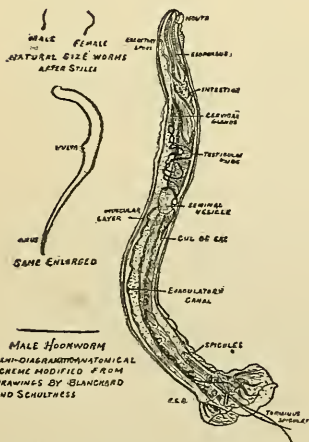
A CYSTICERCUS — BRAIN
AFTER LEUCKART

The above crude drawings serve to draw attention to the fact that parasites play a larger share in modern sanitation and preventive medicine than is realized by the general practitioner.

A person who harbors a tape worm may soil his fingers and reinfect himself. Where the cysticercal stage may develop is very uncertain. The drawings show cysticerci of the eye and brain, but other organs may be involved.

Permit me to urge physicians to study parasites in the clinical aspect. They produce an immense amount of disease.

HOOKWORM



Hygienic Laboratory Bulletin No. 10 gives a wealth of detail concerning hookworm disease. Uncinariasis is endemic in many parts of the South, and has long been common in Europe. Infection takes place through the mouth and produces a very marked anemia.

The infection is common in rural sand districts and large areas are infested.

The United States Public Health and Marine Hospital Service is strenuously fighting the disease in this country and Puerto Rico. The disease is treated by administering thirty grains of thymol at 8 and 10 A.M., followed by a dose of castor oil or magnesia at noon. Iron tonics are then given for some time.

THE BEDBUG*

The presence of the bedbug (*Cimex lectularius*) in a house is not necessarily an indication of neglect and carelessness; for, little as the idea may be relished, this insect may often gain access in spite of the best of care and the adoption of all reasonable precautions. It is very apt to get into the trunks and satchels of travelers, and may thus be introduced into homes. Unfortunately, also, it is quite capable of migrating from one house to another, and will often continue to come from an adjoining house, some times for a period of several months, gaining entrance daily. Such migration is especially apt to take place if the human inhabitants of an infested house leave it. With the failure of their usual source of food, the migratory instinct of the bedbugs is developed; and, escaping through windows, they pass along walls, water pipes, or gutters, and thus gain entrance into adjoining houses. In these or other ways it may be any one's misfortune to have his premises temporarily invaded.

As with nearly all insects associated with man, the bedbug has had the habits now characteristic of it as far back as the records run. It was undoubtedly of common occurrence in the dwellings of the ancient peoples of Asia. The Romans were well acquainted with it, giving it the name *cimex*. It was supposed by Pliny (and this was doubtless the common belief among the Romans) to have medicinal properties, and it was recommended, among other things, as a specific for the bites of serpents. It is said to have been first introduced into England in 1503, but the references to it are of such a nature as to make it very probable that it had been there long before. Two hundred and fifty years later it was reported to be very abundant in the seaport towns, but was scarcely known inland.

The bedbug has accompanied man wherever he has gone. Vessels are almost sure to be infested with it. It is not especially limited by cold, and is known to occur well north. It probably came to this country with the earliest colonists; at least Kalm, writing in 1748-9, stated that it was plentiful in the English colonies and in Canada, though unknown among the Indians.

The bedbug belongs to the order hemiptera, which includes the true bugs or piercing insects, characterized by possessing a piercing and sucking beak. The absence of wings is a most fortunate circumstance, since otherwise there would be no safety from this pest, even for the most careful and thorough housekeepers.

A closely allied species is a parasite messmate in the nests of the common cliff or eaves swallow in this country, and it often happens that the nests of such birds are fairly alive with these vermin. The latter not infrequently gain access to houses and cause the housekeeper considerable alarm. At least three species occur also in England, all very closely resembling the bedbug. One of these is found in pigeon cotes, another in the nests of the English martin, and a third in places frequented by bats. What seems to be the true bedbug, or at best a mere variety, occurs occasionally in poultry houses.

The most characteristic feature of the insect is the very distinct and disagreeable odor which it exhales, an odor well known to all who have been familiar with it as the "buggy" odor. This odor is by no means limited to the bedbug, but is characteristic of most plant bugs also. The common chinch bug, affecting small grains, and the squash bug all possess this odor, and it is quite as pungent with these plant-feeding forms as with the human parasite. The possession of this odor, disagreeable as it is, is, after all, a most fortunate circumstance, as it is of considerable assistance in detecting the presence of these vermin. The odor comes from glands, situated in various

*Condensed from a paper by C. L. Marlatt, of the Bureau of Entomology, Department of Agriculture, and published as Circular No. 47, revised edition.

parts of the body, which secrete a clear, oily, volatile liquid. With the plant-feeding forms this odor is certainly a means of protection against insectivorous birds, rendering these insects obnoxious or distasteful to their feathered enemies. With the bedbug, on the other hand, it is probably an illustration of a very common phenomenon among animals; *i.e.*, the persistence of a characteristic which is no longer of any especial value to the possessor. The natural enemies of true bugs, against which this odor serves as a means of protection, in the conditions under which the bedbugs live, are kept away from it; and the roach, which sometimes feeds on bedbugs, is evidently not deterred by the odor, while the common house ant, which will also attack the bedbug, seems not to find this odor disagreeable.

The bedbug is thoroughly nocturnal in habits and displays a certain degree of wariness and caution, or intelligence, in its efforts at concealment during the day. It thrives particularly in filthy apartments and in old houses which are full of cracks and crevices in which it can conceal itself beyond easy reach. It usually leaves the bed at the approach of daylight to go into concealment, either in cracks in the bedstead, if the latter be one of the old wooden variety, or behind wainscoting or under loose wallpaper, in these places manifesting its gregarious habit of collecting in masses. The old-fashioned, heavy wooden bedsteads are especially favorable for the concealment and multiplication of this insect, and the general use in later years of iron and brass bedsteads has very greatly facilitated its eradication. Bedbugs are not apt to be very active in winter, especially in cold rooms, and ordinarily hibernate in their places of concealment.

The bedbug, though normally feeding on human blood, seems to be able to subsist, for a time at least, on much simpler food; and, in fact, the evidence is pretty conclusive that it is able to get more or less sustenance from the juices of moistened wood, or the moisture in the accumulations of dust, etc., in crevices in flooring. No other explanation would seem to account for the fact that houses long unoccupied are found, on being reinhabited, to be thoroughly stocked with bedbugs.

There is a very prevalent belief among the old settlers in the West that this insect normally lives on dead or diseased cottonwood logs, and is almost certain to be abundant in log houses of this wood. This belief was recently voiced by Captain S. M. Swigert, U. S. A., who reports that it often occurs in numbers under the bark of dead trees of cottonwood (*populus monilifera*), especially along the Big and Little Horn rivers in Montana.

The origin of this misconception, for such it is, so far as the out of door occurrence is concerned, is probably, as pointed out by Professor Riley, from a confusion of the bedbug with the immature stages of an entirely distinct insect (*aradus* sp.), which somewhat resembles the former and often occurs under cottonwood bark. In houses, green or moist cottonwood logs or lumber may actually furnish sustenance to the bedbugs in the absence of its usual food. The bedbug, is, however known to be able to survive for long periods without food, specimens having been kept for a year in a sealed vial, with absolutely no means of sustenance whatever, and in unoccupied houses it can undoubtedly undergo fasts of extreme lengths. Individuals obtained from eggs have been kept in small sealed vials in this office for several months, remaining active and sprightly in spite of the fact that they had never taken any nourishment whatever.

The bite of the bedbug is decidedly poisonous to some individuals, resulting in a slight swelling and disagreeable inflammation. This inflammation seems to result merely from the puncture of the skin by the sharp piercing setæ which constitute the puncturing element of the mouth parts, as there seems to be no secretion of poison other than the natural fluids of the mouth.

The biting organ of the bedbug is exactly like that of other hemipterous insects. It consists of a rather heavy, fleshy under lip (the only part ordinarily seen in examining the insect), within which lie four thread-like filaments or setæ which glide over each other with an alternating motion and pierce the flesh. The blood is drawn up through the beak, which is closely applied to the point of puncture, and the alternating motion of the setæ in the flesh causes the blood to flow more freely. In common with other insects which attack man, it is entirely possible for these pests to be transmitters of contagious diseases.

Like its allies, the bedbug undergoes an incomplete metamorphosis, the young being very similar to their parents in appearance, structure, and habit. The eggs are white oval objects, having a little projecting rim around one edge, and are laid in batches of from one half dozen to fifty in cracks and crevices where the bugs go for concealment. The eggs hatch in a week or ten days, and the young escape by pushing the lid within the projecting rim from the shell. At first the larvæ are yellowish white, nearly transparent, the brown color of the more mature insect increasing with the later molts. During the course of development the skin is shed five times, and with the last molt the minute wing pads characteristic of the adult insect make their appearance. A period of about eleven weeks has been supposed to be necessary for the complete maturity of this insect, but we have found this period subject to great variation, depending upon warmth and food supply. Breeding experiments conducted at this office indicate, under most favorable conditions, a period averaging eight days between moltings and between the laying of the eggs and their hatching, giving about seven weeks as the period from egg to adult insect. Some individuals under the same conditions, however, will remain two or three weeks between moltings; and without food, as already shown, they may remain unchanged, for an indefinite time. Ordinarily but one meal is taken between molts, so that each bedbug must puncture its host five times before becoming mature, and at least once afterward before it again develops eggs. Bedbugs are said to lay several batches of eggs during the season, and are extremely prolific (as occasionally realized by the housekeeper, to her chagrin and embarrassment).

That the bedbug may be destroyed in houses by fumigating with hydrocyanic acid gas has been fully demonstrated during the last few years. The gas penetrates every crevice in the house or room where the bedbugs conceal themselves, and has an immediate effectiveness which gives it an important recommendation, especially when the infestation is considerable or of long standing.*

The old remedies, which follow, are effective enough, though at a greater cost of time and personal effort, yet will often be of service for slight infestation or where the employment of the more poisonous cyanide is objected to or is impracticable.

The bedbug, on account of its habits of concealment, is usually beyond the reach of powders, and the ordinary insect powders, such as pyrethrum, are of practically no avail against it. If iron or brass bedsteads are used, the eradication of the insect is comparatively easy. With large wooden bedsteads, furnishing many cracks and crevices into which the bugs can force their flat, thin bodies, extermination becomes a matter of considerable difficulty. The most practicable way to effect this end is by very liberal application of benzine or kerosene or any of the petroleum oils. These must be introduced into all crevices with small brushes or feathers, or by injecting with small

*The process is attended by grave danger, even when applied by experts, as was shown by the report of several cases of poisoning in the *Circular* for March, page 271. It is mentioned here merely to give us an opportunity to utter this warning.— Editor *The Druggists' Circular*.

syringes. Corrosive sublimate is also of value,* and oil of turpentine may be used in the same way. The liberal use of hot water, wherever it may be employed without danger to furniture, etc., is also an effectual method of destroying both eggs and active bugs. Various bedbug remedies and mixtures are for sale, most of them containing one or another of the ingredients mentioned, and these are frequently of value. The great desideratum, however, in a case of this kind, is a daily inspection of beds and bedding, and of all crevices and locations about the premises where these vermin may have gone for concealment. A vigorous campaign should, in the course of a week or so at the outside, result in the extermination of this very obnoxious and embarrassing pest.

In the case of rooms containing books, or where liquid applications are inadvisable, a thorough fumigation with brimstone is, on the authority of the late Dr. J. A. Lintner, then New York State entomologist, an effective means of destruction. He says:

"Place in the center of the room a dish containing about four ounces of brimstone, within a larger vessel, so that the possible overflowing of the burning mass may not injure the carpet or set fire to the floor. After removing from the room all such metallic surfaces as might be affected by the fumes, close every aperture, even the keyholes, and set fire to the brimstone. When four or five hours have elapsed the room may be entered and the windows opened for a thorough airing."

The sulphur or brimstone remedy has been used very successfully by Dr. C. W. Stiles, of the bureau of public health and marine hospital service, for the disinfection of frame cottages, such as those at seaside resorts, where, from neglect, infestation with bedbugs may often occur. The treatment is inexpensive compared with the use of hydrocyanic acid gas, and offers much less risk of danger to human beings. Two pounds of sulphur are recommended for each thousand cubic feet of space, and the buildings should be closed for treatment at least twenty-four hours. Sulphur candles may be used where available. The precautions indicated in the quotation from Dr. Lintner should be observed.

The fact that the bedbug has a very active enemy in the common house cockroach has already been alluded to, and the proof seems to be fairly conclusive. Another common insect visitor in houses, and a very annoying one also to the careful housekeeper, the little red ant (*monomorium pharaonis*), is also known to be a very active and effective enemy of the bedbug. Mr. Theo Pergande, of this office, informs me that during the Civil War, when he was in the Union army, he occupied at one time barracks at Meridian, Miss., which had been abandoned some time before. The premises proved to be swarming with bedbugs; but very shortly afterwards the little red house ant discovered the presence of the bedbugs and came in enormous numbers, and Mr. Pergande witnessed the very interesting and pleasing sight of the bedbugs being dismembered or carried away bodily by these very minute ants, many times smaller than the bugs which they were handling so successfully. The result was that in a single day the bedbug nuisance was completely abated. The liking of red ants for bedbugs is confirmed also by a correspondent writing from Florida (F. C. M. Boggess), who goes so far as to heartily recommend the artificial introduction of the ants to abate this bug nuisance.—*The Druggists' Circular*.

*This statement has been questioned, the argument being that it is the solvent of the corrosive sublimate and not the salt itself that kills the bug.—Editor *The Druggists' Circular*.

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